

Installation, Start-up, and Operating Instructions

Gas-Fired Direct Vent Condensing Hot Water Boiler Sizes 50,000 through 100,000 Series A

BW9

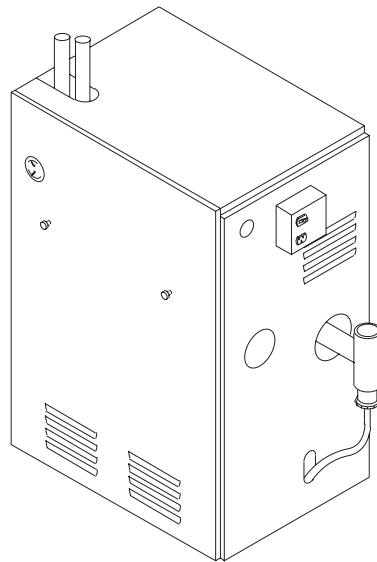


NOTE: Read the entire instruction manual before starting the installation.

This symbol → indicates a change since the last issue.¹

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SAFETY CONSIDERATIONS

Recognize safety information. This is the safety-alert symbol . When you see this symbol on the furnace and in instructions or manuals, be alert to the potential for personal injury. Understand the signal words DANGER, WARNING, CAUTION, and NOTE. These words are used with the safety-alert symbol. DANGER identifies the most serious hazards which **will** result in severe personal injury or death. WARNING signifies a hazard which **could** result in personal injury or death. CAUTION is used to identify unsafe practices which **would** result in minor personal injury or product and property damage. NOTE is used to highlight suggestions which will result in enhanced installation, reliability, or operation. These instructions cover minimum requirements and conform to existing national standards and safety codes. In some instances, these instructions exceed certain local codes and ordinances, especially those that may not have kept up with changing residential construction practices. We require these instructions as a minimum for a safe installation.

1. Read the entire installation manual before beginning the installation. Failure to follow these rules and these instructions for safe installation and operation could cause a malfunction of the boiler and result in death, serious bodily injury, and/or property damage.
2. Check all applicable state and local building codes and utility company requirements before installation. The installation must conform with these requirements in their entirety. In the absence of these codes, use NFPA Installation Codes and good industry practice.
3. Before servicing the boiler allow the boiler to cool. Always shut off any electricity and gas supply connected to the boiler prior to servicing.
4. Inspect gas line for leaks.
5. Be certain gas input rate is correct. Over-firing may result in early failure of the boiler sections. This may cause dangerous operation. Over firing may result in too much air for the pre-mix burner causing poor or loss of combustion.
6. Never vent the products of combustion from this boiler to an enclosed space. Always vent to the outdoors. Never vent to another room or inside a building.
7. Be sure there is adequate outdoor air supply to the boiler for complete combustion.
8. Follow a regular service and maintenance schedule for efficient and safe operation.
9. Keep boiler area clean of debris and free of combustible and flammable materials.
10. Proper through the wall or through the roof combustion venting shall be in accordance with the materials and methods described in this manual.
11. This boiler and related hot water heating systems are not do it yourself items. They must be installed and serviced by qualified professionals.

⚠ WARNING: This boiler has been equipped for residential installations. If used for commercial applications, any additional code requirements must be adhered to for installation. This may require additional controls including but not limited to a low water cut off, a manual reset high temperature limit, and wiring and/or piping modifications. The manufacturer is not responsible for any field installation changes made to a boiler installation which are not described or acknowledged in this manual.

INTRODUCTION

The BW9 is a gas-fired direct vent condensing hot water boiler with cast aluminum heat exchanger sections. A revolutionary cast aluminum heat exchanger means better heat transfer and thermal storage than similarly sized cast iron boilers, which results in higher efficiency. The heating system water absorbs large amounts of heat from the cast aluminum heat exchanger, cooling the flue gases and causing condensation. Sealed combustion, premix gas burner, and low flame temperature means drastically reduced CO and NOx emissions, which contribute to a cleaner and healthier environment.

The BW9, unlike normal residential atmospheric and induced draft boilers, takes its combustion air directly from the outdoors (sealed combustion) and does not compete with building occupants for fresh air. Sealed combustion (also known as “direct vent”) is the safest and best way to obtain plenty of clean combustible air. The induced draft fan draws in the outside combustion air, then takes the cooler flue gases from the heat exchanger and provides a positive removal of the flue gases from the building through inexpensive and readily available PVC and CPVC pipes.

PROCEDURE 1—BOILER RATINGS AND CAPACITIES

These low pressure gas-fired hot water boilers are design certified by CSA (AGA and CGA) for use with natural and propane gases. The boiler is constructed and hydrostatically tested for a maximum working pressure of 50 psig (pounds per square inch gauge) in accordance with A.S.M.E. (American Society of Mechanical Engineers) Boiler and Pressure Vessel Code Section IV Standards for heating boilers.

NOTE: AFUE (Annual Fuel Utilization Efficiency) and Heating Capacity is based on D.O.E. (Department of Energy) test procedure.

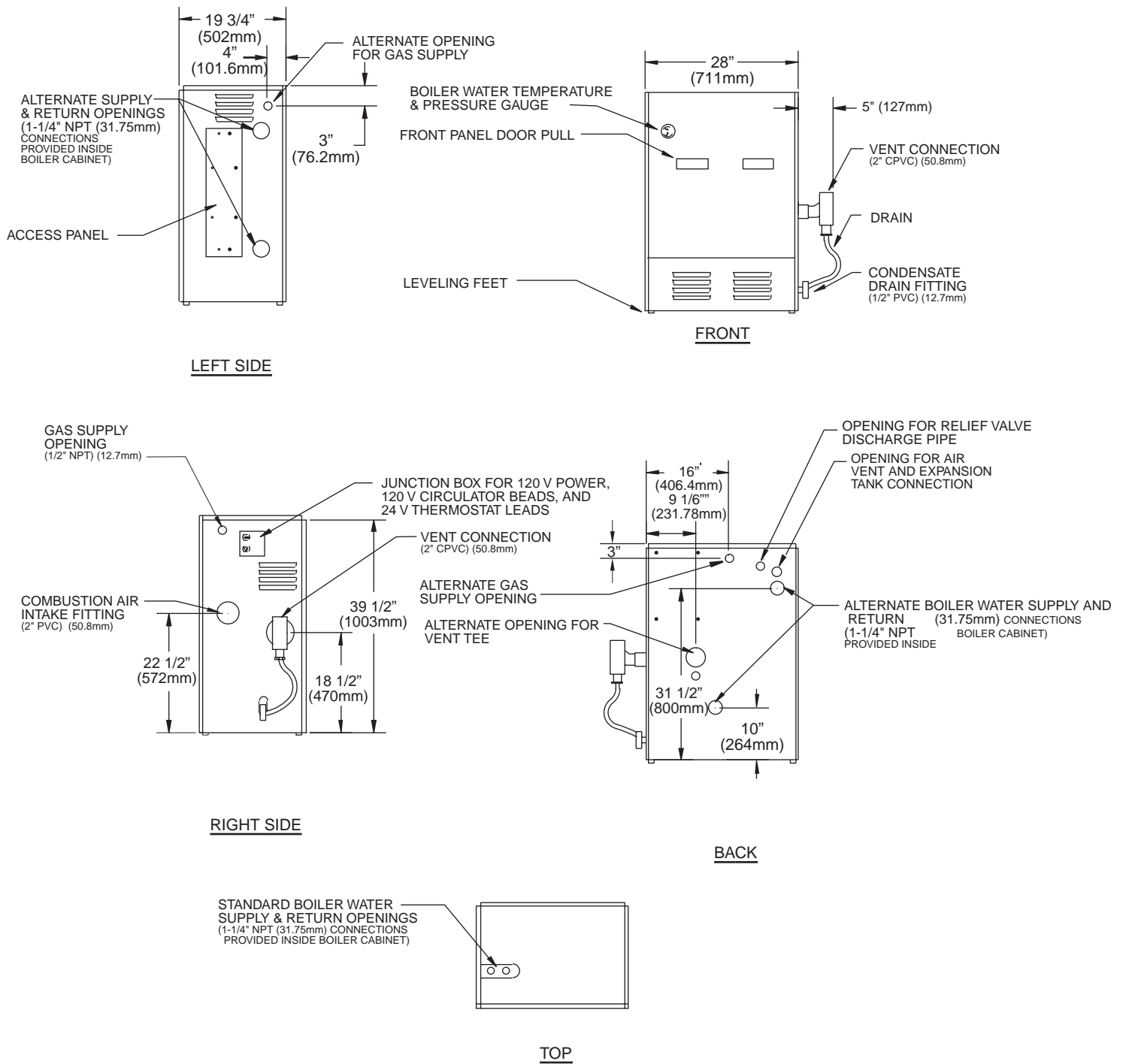
NOTE: The BW9 boilers are certified in accordance with ANSI (American Standards Institute) Z21.13 standards as gas-fired direct vent condensing hot water boilers.

The **Heating Capacity** indicates the amount of heat available after subtracting the losses out the vent. Most of this heat is available to heat water. A small portion is heat from the jacket and surfaces of the boiler, and it is assumed that this heat stays in the structure. The Net I=B=R Rating represents the portion of the remaining heat that can be applied to heat the radiation or terminal units (i.e. finned tube baseboard, cast iron radiators, radiant floor, etc.). The difference between the Heating Capacity and the Net I=B=R Rating, called the piping and pickup allowance, establishes a reserve for heating the volume of water in the system and offsetting heat losses from the piping. The Net I=B=R Ratings shown are based on a piping and pickup factor of 1.15 in accordance with the I=B=R Standard as published by the Hydronics Institute. The Net I=B=R Rating of the boiler should be greater than or equal to the calculated peak heating load (heat loss) for the building or area(s) served by the boiler and associated hot water heating systems. The manufacturer should be consulted before selecting a boiler for installation having unusual piping and pickup requirements.

A. Boilers for use at High Altitude

U.S.A. Only—For altitudes above 2000 ft above sea level, input ratings should be reduced at the rate of 4 percent for each 1000 ft above sea level. Consult the National Fuel Gas Code (NFGC NFPA54-2002/ANSI Z223.1-2002 - latest edition), or the manufacturer for correct orifice sizing information. High-altitude orifices are available from boiler manufacturer.

Canada Only—For altitudes in the range of 2000-4500 ft above sea level, boilers may be field equipped for use at high altitude by using a certified field conversion kit. The change in main burner orifice size results in boiler’s input rating being reduced by 10 percent. The conversion shall be carried out by a manufacturer’s authorized representative in accordance with the requirements of manufacturer, provincial or territorial authorities having jurisdiction, and in accordance with the requirements of the CAN/CGA-B149.1 and CAN/CGA-B149.2 Installation Codes. The certified field conversion kit includes a conversion data plate, indicating that the boiler has been converted for high altitude use. The correct conversion information must be entered on the conversion data plate.



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Fig. 2—BW9 Boiler Detail

Table 1—Sea Level Ratings (Natural and Propane Gases)

BOILER MODEL NUMBER	NATURAL AND PROPANE GAS			SHIPPING WEIGHT (LBS.)	VENT CONNECTION DIAMETER
	A.G.A. Input MBH	Heating Capacity MBH	Net I=B=R Rating MBH		
BW9AAN000050AAAA	50.0	45	39	220	2-in. CPVC
BW9AAN000075AAAA	75.0	68	59	220	2-in. CPVC
BW9AAN000100AAAA	100.0	90	78	220	2-in. CPVC

MBH=1000 Btuh (British Thermal Unit Per Hr)

**Table 2—Natural Gas High Altitude Ratings**

ELEVATION (FT.)	0–2000	3000	4000	5000	6000	7000	7500	8500
BW9–50								
Normal Input (MBH)	50.0	48.0	47.8	47.5	46.0	44.0	43.5	42.0
Heating Capacity (MBH)	45.0	43.2	43.0	42.8	41.4	39.6	39.2	37.8
Net I=B=R Rating (MBH)	39.0	37.4	37.3	37.1	35.9	34.3	34.0	32.8
Gas Orifice Drill Size	.0615	.0615	.0615	.0615	.0615	.0615	.0615	.0615
Manifold Pressure (Inches Water Column)	2.5	2.7	3.0	3.2	3.1	3.0	2.8	2.7
Pressure Switch Setpoint (Inches Water Column)	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55
BW9–75								
Normal Input (MBH)	75.0	70.0	69.0	68.0	63.5	58.0	56.5	52.0
Heating Capacity (MBH)	68.0	63.0	62.1	61.2	57.2	52.2	50.9	46.8
Net I=B=R Rating (MBH)	58.9	54.6	53.8	53.0	49.6	45.2	44.1	40.6
Gas Orifice Drill Size	.0760	.0760	.0760	.0760	.0760	.0760	.0760	.0760
Manifold Pressure (Inches Water Column)	2.5	2.7	2.8	3.0	2.8	2.6	2.3	2.1
Pressure Switch Setpoint (Inches Water Column)	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35
BW9–100								
Normal Input (MBH)	100.0	97.0	96.0	95.0	90.0	84.0	82.0	76.0
Heating Capacity (MBH)	90.0	87.3	86.4	85.5	81.0	75.6	73.8	68.4
Net I=B=R Rating (MBH)	78.0	75.7	74.9	74.1	70.2	65.5	64.0	59.3
Gas Orifice Drill Size	.0860	.0860	.0860	.0860	.0860	.0860	.0860	.0860
Manifold Pressure (Inches Water Column)	2.5	2.9	3.3	3.7	3.4	3.2	2.9	2.6
Pressure Switch Setpoint (Inches Water Column)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

**Table 3—Propane Gas High Altitude Ratings**

ELEVATION (FT.)	0–2000	3000	4000	5000	6000	7000	7500	8500
BW9–50								
Normal Input (MBH)	50.0	49.0	49.0	49.0	48.0	46.5	46.0	44.0
Heating Capacity (MBH)	45.0	44.1	44.1	44.1	43.2	41.9	41.4	39.6
Net I=B=R Rating (MBH)	39.0	38.2	38.2	38.2	37.4	36.3	35.9	34.3
Gas Orifice Drill Size	.0492	.0492	.0492	.0492	.0492	.0492	.0492	.0492
Manifold Pressure (Inches Water Column)	2.5	2.8	3.1	3.4	3.4	3.5	3.5	3.5
Pressure Switch Setpoint (Inches Water Column)	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55
BW9–75								
Normal Input (MBH)	75.0	70.0	69.0	67.0	66.0	64.5	64.0	62.0
Heating Capacity (MBH)	68.0	63.0	62.1	60.3	59.4	58.1	57.6	55.8
Net I=B=R Rating (MBH)	58.9	54.6	53.8	52.3	51.5	50.4	49.9	48.4
Gas Orifice Drill Size	.0605	.0605	.0605	.0605	.0605	.0605	.0605	.0605
Manifold Pressure (Inches Water Column)	2.5	2.4	2.3	2.2	2.2	2.2	2.3	2.3
Pressure Switch Setpoint (Inches Water Column)	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35
BW9–100								
Normal Input (MBH)	100.0	95.0	94.0	92.0	92.0	91.5	91.5	91.0
Heating Capacity (MBH)	90.0	85.5	84.6	82.8	82.8	82.4	82.4	81.9
Net I=B=R Rating (MBH)	78.0	74.1	73.3	71.8	71.8	71.4	71.4	71.0
Gas Orifice Drill Size	.0670	.0670	.0670	.0670	.0670	.0670	.0670	.0670
Manifold Pressure (Inches Water Column)	2.5	2.7	2.9	3.1	3.2	3.3	3.4	3.5
Pressure Switch Setpoint (Inches Water Column)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

INSTALLATION

PROCEDURE 1—BEFORE INSTALLING THE BOILER

Complete all of the following prior to installing the boiler.

A. Codes

This boiler product is a gas fired direct vent condensing hot water boiler and must be installed in accordance with all applicable federal, state, and local building codes including, but not limited to the following:

U.S.A.—Installation shall conform with NFPA-54/ANSI Z223.1.

Canada—Installation shall be in accordance with CAN/CGA B149.1 and .2 Installation Codes. Where required by the authority having jurisdiction, the installation must conform to the A.S.M.E. Safety Code for Controls and Safety Devices for Automatically Fired Boilers, CSD-1. The installation must conform to the requirements of the authority having jurisdiction or, in the absence of such requirements, to the NFGC, ANSI Z223.1.

→ **Installers**—Follow local regulations with respect to installation of CO (Carbon Monoxide) Detectors. Follow maintenance recommendations in this manual.

Table 4—Gas-Fired Hot Water Boiler Clearances

UNIT	COMBUSTIBLE CONSTRUCTION (IN.)	ACCESSIBILITY / CLEANING (IN.)	SERVICING (IN.)
TOP	1	8	8
LEFT SIDE	1	24	24
RIGHT SIDE	8	—	—
BASE	1	—	—
FRONT	0	24	24
BACK	1	—	—
INTAKE/VENT PIPING	0	—	—
NEAR BOILER HOT WATER PIPING	1	—	—

→ **Techniciens**—Veuillez vous conformer à la réglementation en vigueur concernant l'installation des détecteurs d'oxyde de carbone. Suivre les consignes d'entretien figurant dans le manuel d'instruction ci-joint.

B. Boiler Sizing

1. Check to be sure you have selected the BW9 boiler with the proper capacity before starting the installation. The I=B=R Rating of the boiler selected should be greater than or equal to the calculated peak heating load (heat loss) for the building or area(s) served by the boiler and associated hot water heating systems. See boiler rating and capacity table on page 5 of this manual.
2. Heat loss calculations should be based on approved industry methods.

C. Considerations for Boiler Locations

Before selecting a location for the boiler, the following should be considered. Each boiler considered for installation must be:

1. Supplied with the correct type of gas (natural or propane).
2. Connected to a suitable combustion air intake piping system to supply the correct amounts of fresh (outdoor) air for combustion. (Maximum length 80 ft for BW9-100 boiler, and Maximum length 100 ft for BW9-75 and BW9-50 boilers).
3. Connect to a suitable venting system to remove the hazardous products of gas combustion (Maximum length 80 ft for BW9-100 boiler, and Maximum length 100 ft for BW9-75 and BW9-50 boilers).
4. Connected to a suitable hot water heating system.
5. Supplied with a suitable electrical supply for all motors and controls.
6. Connected to a properly located thermostat or operating control (not included with boiler).
7. Placed on level surface (must **NOT** be installed on carpeting).
8. Condensate drain line must be pitched down to floor drain or external condensate pump with reservoir at 1/4-in. per foot (wood frame or blocks may be used to raise boiler).

D. Locating the Boiler

1. Select a location which is level, central to the piping systems served and as close to the vent and air intake terminals as possible.
2. Accessibility clearances, if more stringent (i.e. larger clearances) than required fire protection clearances, must be used for the boiler installation. Accessibility clearances may be achieved with the use of removable walls or partitions.
3. The boiler is approved for installation in closets and on combustible floors. This boiler shall **NOT** be installed on carpeting.
4. The clearances shown in Table 4 indicate required clearances per AGA and CGA listing. A minimum 1-in. clearance must be maintained between combustible construction and each of the left, right, top, and back surfaces of the boiler. A minimum 8-in. clearance is required on the right side, to allow room for the inlet air pipe. An 18-in. clearance must be maintained at a side where passage is required to access another side for cleaning or servicing, inspection or replacement of any parts that normally may require such attention. Allow at least 24-in. at the front and left side and 8-in. at the top for servicing. No clearances are required to venting or combustion air intake piping.
5. Equipment shall be installed in a location which facilitates the operation of venting and combustion air intake piping systems as described in this manual.
6. Advise owner of boiler to keep venting and combustion air intake passages free of obstructions. Both the venting and combustion air intake piping systems connected to the outdoors must permit flow through the piping systems without restrictions for the boiler to operate.
7. The boiler shall be installed such that the automatic gas ignition system components are protected from water (dripping, spraying, rain, etc.) during operation and service (circulator replacement, control replacement, etc.).

E. Combustion Air and Vent Pipe Requirements

This boiler requires a dedicated direct vent system. In a direct vent system, all air for combustion is taken directly from outside atmosphere, and all flue products are discharged to outside atmosphere. Combustion air and vent pipe connections must terminate together in the same atmospheric pressure zone, either through the roof or sidewall (roof termination preferred). See Fig. 10, 11, 12, and 13 for required clearances.

⚠ WARNING: Keep boiler area clean of debris and free of flammable and combustible materials, vapors and liquids. Failure to follow this warning could result in explosion, electrical shock, fire, personal injury, or death.

⚠ WARNING: Improper installation, adjustment, alteration, service, maintenance, or use can cause carbon monoxide poisoning, explosion, fire, electrical shock, or other conditions which may cause personal injury or property damage. Consult a qualified installer, service agency, local gas supplier, or your distributor or branch for information or assistance. The qualified installer or agency must use only factory-authorized and listed kits or accessories when modifying this product. Failure to follow this warning can cause electrical shock, fire, personal injury, or death.

⚠ WARNING: When vent pipe is exposed to temperature below freezing, such as when it passes through an unheated space or when a chimney is used as a raceway, vent pipe must be insulated with 1/2-in. Armaflex or equivalent. In extreme cold climate areas, use 3/4-in. Armaflex or equivalent. Combustion air must be clean outdoor air. Combustion air must not be taken from inside structure because that air frequently is contaminated by halogens, which include fluorides, chlorides, phosphates, bromides, and iodides. These elements are found in aerosols, detergents, bleaches, cleaning solvents, salts, air fresheners, paints, adhesives and other household products. Locate combustion air inlet as far away as possible from swimming pool and swimming pool pump house. All combustion air and vent pipes must be airtight and watertight. Combustion air and vent piping must also terminate exactly as shown in Fig. 10, 11, 12, and 13. Vent connections serving appliances vented by natural draft shall not be connected into any portion of mechanical draft systems operating under positive pressure. Solvent cements are combustible. Keep away from heat, sparks, and open flame. Use only in well ventilated areas. Avoid breathing in vapor or allowing contact with skin or eyes. Failure to follow the aforementioned warnings could result in fire, property damage, personal injury, or death.

F. Condensate Drain Requirements

Condensate drain line to be pitched to floor drain at a minimum of 1/4-in. per foot. An external condensate pump (not furnished) may be used if floor drain is not available. The condensate pump must be designed for flue gas condensate application.

NOTE:

1. Condensate trap is built into boiler. External trap is not required and should not be used.
 2. Wood frame or blocks may be used to raise boiler to maintain drain pitch or to be above external condensate pump reservoir.
 3. There is a 115 volt AC receptacle provided on the service switch junction box which is located at the boiler right side, to provide power for an external condensate pump (if needed).
- 4. The receptacle is wired ahead of the ON/OFF switch assembly. If the switch is turned off, the receptacle is still energized.

G. Foundation Requirements

Boiler must be placed on level surface. Boiler is NOT to be installed on carpeting.

NOTE:

1. If boiler is not level, condensate drain lines will not function properly. Adjustable feet are located on the boiler to make up for minor surface irregularities or tilt.
2. Wood frame or blocks may be used to raise boiler to maintain drain pitch or to be above external condensate pump reservoir.

H. Removal of Existing Boiler from Common Vent System

→ When an existing Category I furnace is removed or replaced, the original venting system may no longer be sized to properly vent the remaining attached appliances. An improperly sized Category I venting system could cause the formation of condensate in the furnace and vent, leakage of condensate and combustion products, spillage of combustion products into the living space, etc.

→ ⚠ **WARNING:**

CARBON MONOXIDE POISONING HAZARD

Failure to follow the steps outlined below for each appliance connected to the venting system being placed into operation could result in carbon monoxide poisoning or death.

The following steps shall be followed for each appliance connected to the venting system being placed into operation, while all other appliances connected to the venting system are not in operation:

1. Seal any unused openings in venting system.
2. Inspect the venting system for proper size and horizontal pitch, as required in the National Fuel Gas Code, ANSI Z223.1-2002/NFPA 54-2002 or the CSA B149.1, Natural Gas and Propane Installation Code and these instructions. Determine that there is no blockage or restriction, leakage, corrosion and other deficiencies, which could cause an unsafe condition.
3. As far as is practical, close all building doors and windows and all doors between the space in which the appliance(s) connected to the venting system are located and other spaces of the building.
4. Close fireplace dampers.
5. Turn on clothes dryers and any appliance not connected to the venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they are operating at maximum speed. Do not operate a summer exhaust fan.
6. Follow the lighting instructions. Place the appliance being inspected into operation. Adjust the thermostat so appliance is operating continuously.
7. Test for spillage from draft hood equipped appliances at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle.
8. If improper venting is observed during any of the above tests, the venting system must be corrected in accordance with the National Fuel Gas Code, ANSI Z223.1-2002/NFPA 54-2002 and/or CSA B149.1, Natural Gas and Propane Installation Code.
9. After it has been determined that each appliance connected to the venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas-fired burning appliance to their previous conditions of use.

PROCEDURE 2—PLACING THE BOILER

The boiler should be placed to provide the most direct connections to the combustion air, vent and system piping as possible. Place crated boiler as close to the selected location as possible and unpackage boiler. The unpackaged boiler may be moved into position with an appliance dolly or 2-wheel hand truck. The dolly or hand truck should be inserted under the left hand side of the boiler. It is possible to slide the boiler for a short distance on a smooth floor or surface.

NOTE: Refer to manual section "Locating the Boiler" for required clearances for servicing and maintenance.

PROCEDURE 3—NEAR BOILER PIPING

⚠ **CAUTION:** Copper supply and return piping must NOT be installed directly into aluminum boiler section castings due to galvanic corrosion between dissimilar metals. Iron or steel bushings or pipe nipples should be used between copper system piping and boiler to make final connection to boiler. Also the use of dielectric unions is acceptable. The packaged boiler is furnished with iron piping in the front boiler section for the supply and return connections.

When the installation of the boiler is for a new heating system, first install all of the radiation units (panels, radiators, baseboard, or tubing) and the supply and return mains. After all heating system piping and components have been installed, make final connection of the system piping to the boiler. A hot water boiler installed above radiation level must be equipped with a field-supplied accessory low water cut off device. A periodic inspection is necessary, as if flushing of float type devices, per low water cut off manufacturers specific instructions.

A. Supply and Return Lines

The packaged boiler unit is set up to receive 1-1/4-in. NPT supply and return piping from top access. The boiler unit can also be piped from the left side by turning supply elbow, and from the rear of the unit by removing plugs in the rear boiler section.

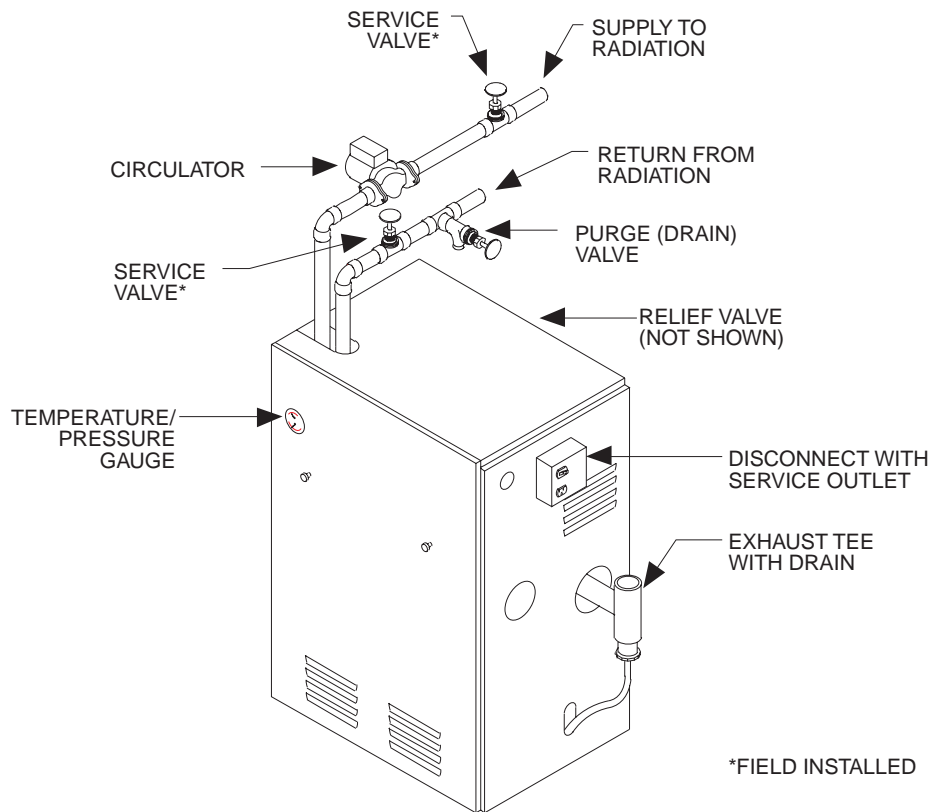
→ **NOTE:** The circulator pump is furnished within a carton inside the boiler cabinet and can be installed at the installer preferred location.

B. Pressure Relief Valve

The boiler is furnished with a factory installed relief valve in the top of the boiler. Provide 3/4-in. piping from the supplied relief valve to a local floor drain, but leave an air gap between piping and drain. No shutoff of any description shall be placed between safety relief valve and the boiler, or on the discharge pipes between such safety valve and the atmosphere. Installation of the safety relief valve shall conform to ANSI/ASME Boiler and Pressure Vessel Code, Section IV. The manufacturer is not responsible for any water damage. (See Fig. 6.)

C. Expansion Tank and Make-Up Water

Determine required system fill pressure, system design temperature, and system water content. Boiler contains 2.6 gallons (U.S.). Size expansion tank accordingly. Consult expansion tank manufacturer for proper sizing information. Connect properly sized expansion tank (not furnished) as shown in Fig. 7 for diaphragm type expansion tank and Fig. 8 for conventional closed type expansion tanks. For diaphragm type expansion tanks, adjust the tank air pressure to match the system fill pressure. Install air vent (furnished) as shown for diaphragm type expansion tank system only. Install make-up water connections as shown and per local codes. If a pressure reducing valve is used, adjust to match the system fill pressure. In connecting the cold make-up water supply to the boiler, make sure that clean water supply is available. When the water supply is from a well or pump, a sand strainer should be installed at the pump.



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Fig. 3—Single Zone Boiler Piping

D. Condensate Drain Piping

Condensate trap is built into boiler. External trap is not required and should NOT be used.

Provide 1/2-in. PVC Condensate drain and fittings. Condensate drain to be pitched down to floor drain at a minimum of 1/4-in. per foot.

Install furnished 1/2-in. PVC tee to overflow fitting as shown in Fig. 9.

The 1/2-in. diameter schedule 40 PVC or CPVC condensate drain piping and pipe fittings must conform to ANSI standards and ASTM D1785 or D2846. Schedule 40 PVC or CPVC cement and primer must conform to ASTM D2564 or F493. In Canada, use CSA or ULC certified schedule 40 PVC or CPVC drain pipe and cement.

A condensate pump with a reservoir (not furnished) may be used to remove condensate to a drain line (sanitary line) above boiler if a floor drain is not available or is inaccessible.

E. Filling Condensate Trap with Water

NOTE: On the initial start up the condensate trap must be manually filled with water. The following are the steps required to initially fill the condensate trap for start up, these steps are only required at the initial start up or if maintenance requires draining of the condensate trap.

1. Disconnect the vent condensate drain line from the bottom of the vent tee on the boiler.
2. Pour about 1 cup of cold tap water into the vent drain line with a proper funnel.
3. Excess water should go through the overflow and out through the condensate drain line. Verify proper operation of the drain line (or external condensate pump if used).
4. Reinstall the vent drain line.

F. Chilled Water Piping

The boiler, when used in connection with a refrigeration system, must be installed so the chiller medium is piped in parallel with the boiler with appropriate valves to prevent the chilled medium from entering the boiler.

The boiler piping system of a hot water boiler connected to heating coils, located in air handling units where they may be exposed to refrigerated air circulation, must be equipped with flow control valves or other automatic means to prevent gravity circulation of the boiler water during cooling cycle.

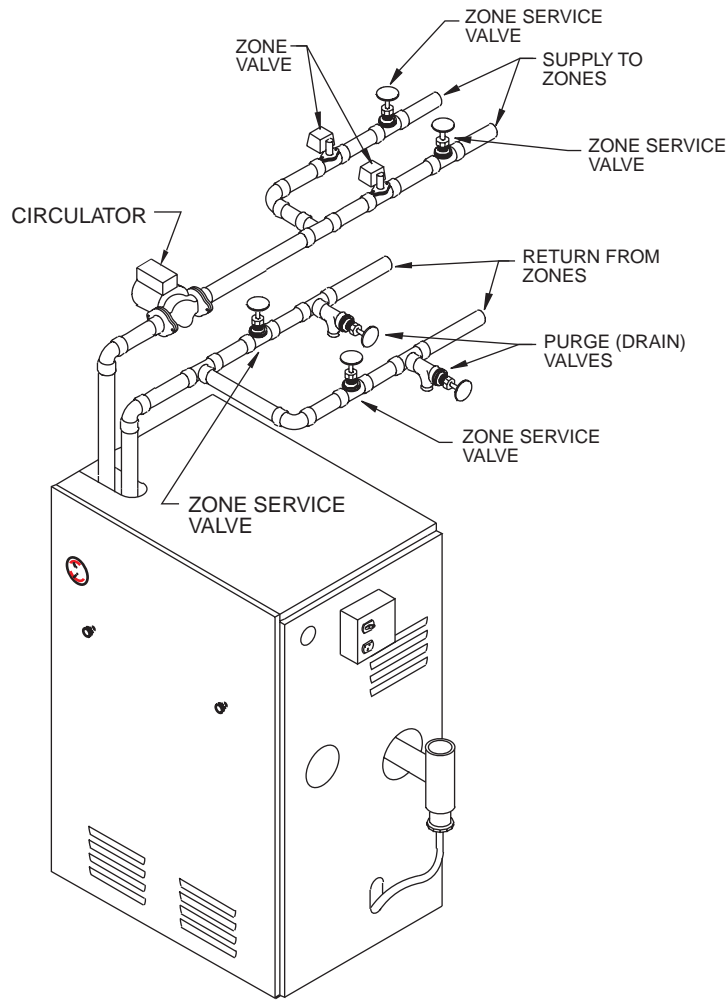
PROCEDURE 4—COMBUSTION AIR AND VENT PIPE

A. Connections and Termination

→ For boilers for connection to gas vents or chimneys, vent installations shall be in accordance with part 7, Venting of Equipment, of the National Fuel Gas Code, NFPA-54-2002/ANSI Z223.1-2002 revision and applicable provisions of the local building codes.

Provisions for combustion and ventilation air must be in accordance with section 5.3, Air For Combustion and Ventilation, of the National Fuel Gas Code, NFPA-54-2002/ANSI Z223.1-2002, or applicable provisions of the local building code.

These boilers require a dedicated direct vent system. All air for combustion is taken directly from outdoors through combustion air intake pipe. All flue products are discharged to the outdoors through vent pipe.



A99158

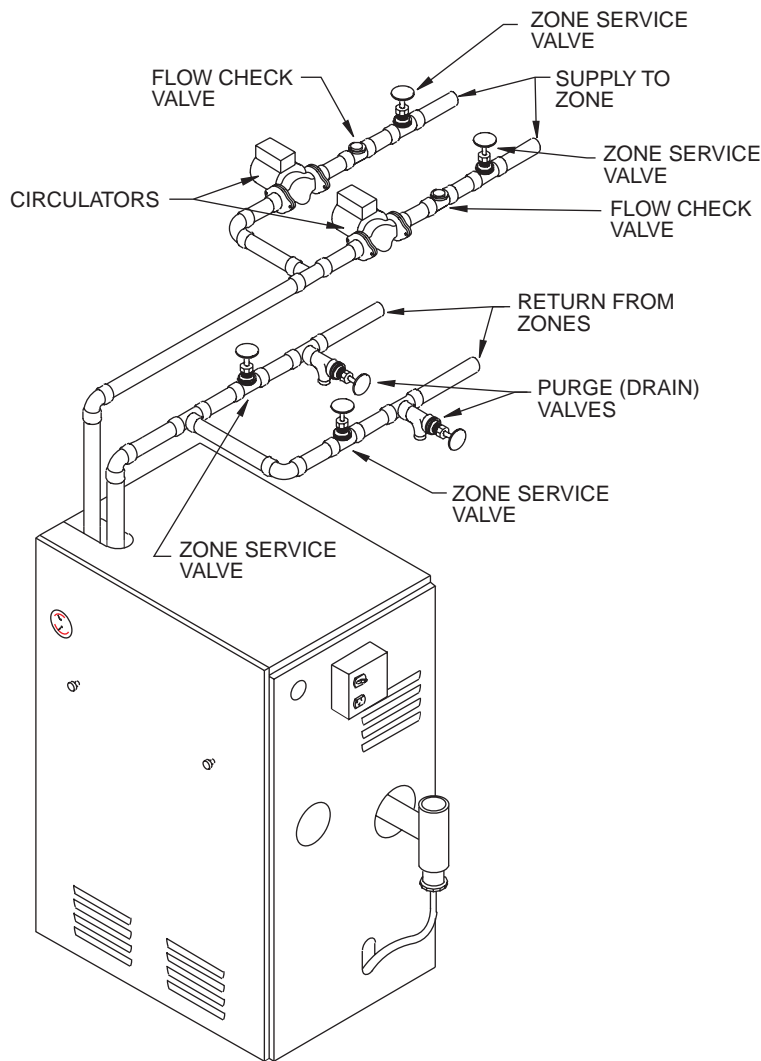
Fig. 4—Multizone Boiler Piping with Zone Valves

- 1. See Fig. 10, 11, 12 and 13 for combustion air and vent pipe roof and sidewall termination. (Roof termination is preferred). Combustion air and vent pipes must terminate together in same atmospheric pressure zone as shown. Construction through which vent and air intake pipes may be installed is a maximum 24-in., minimum 1/4-in. thickness.
- 2. Combustion air and vent pipe fittings must conform to ANSI standards and ASTM standards D1784 (schedule-40 CPVC), D1785 (schedule-40 PVC), D2665 (PVC-DWV), D2241 (SDR-21 and SDR-26 PVC), D2661 (ABS-DWV), or F628 (schedule-40 ABS). Pipe cement and primer must conform to ASTM standards D2564 (PVC) or D2235 (ABS). In Canada construct all combustion air and vent pipes for this unit of CSA or ULC certified schedule-40 CPVC, schedule-40 PVC, PVC-DWV or ABS-DWV pipe and pipe cement.
- 3. SDR pipe is NOT approved in Canada.
- 4. Combustion air and vent piping connections on boiler are sized for 2-in. pipe (See Fig. 12). Any pipe size change (to 3-in.) must be made outside of the boiler casing in vertical run of pipe to allow for proper drainage of vent condensate (See Fig. 13). Due to potential for flue gas temperatures over 155°F, the first 5 ft of vent pipe must be CPVC, the remaining vent pipe can be PVC. If any elbows are employed within the first 5 ft of vent, they must also be CPVC too. The air intake pipe can be PVC. (See Fig. 14 and 15.)

NOTE: Two 2-1/2 foot long sections of 2-in. CPVC and 2-in. CPVC coupling are furnished with the boiler.

NOTE: The transition from 2-in. pipe to 3-in. pipe must be made in a vertical run. (See Fig. 13.)

- 5. Combustion air and vent piping lengths. (See Table 5.)
- 6. Combustion air and vent piping to be pitched back to boiler at minimum 1/4-in. per foot from intake and vent terminals so that all moisture in combustion air and vent piping drains to boiler. Pipes must be pitched continuously with no sags or low spots where moisture can accumulate and block the flow of air or flue gas. Combustion air and vent pipes must be airtight and watertight.
- 7. Consideration for the following should be used when determining an appropriate location for termination of combustion air and vent piping.
 - a. Comply with all clearances required as stated in Table 6 and Fig. 10, 11, 12 and 13.
 - b. Termination should be positioned where vent vapors will not damage plants/shrubs or air conditioning equipment.
 - c. Termination should be positioned so that it will not be affected by wind eddy, airborne leaves, snow, or allow recirculation of flue gases.
 - d. Termination should be positioned where it will not be damaged or subject to foreign objects, such as stones, balls, etc.
 - e. Termination should be positioned where vent vapors are not objectionable.
 - f. Put vent on a wall away from the prevailing winter wind. Locate or guard the vent to prevent accidental contact with people or pets.



A99159

Fig. 5—Multizone Boiler Piping with Circulators

- g. Terminate the vent above normal snowline. Avoid locations where snow may drift and block the vent. Ice or snow may cause the boiler to shut down if the vent becomes obstructed.
- h. Under certain conditions, flue gas will condense, forming moisture, and may be corrosive. In such cases, steps should be taken to prevent building materials at the vent from being damaged by exhaust of flue gas.
- 8. The venting system shall terminate at least 3 ft above any forced air inlet (except the boiler's combustion air inlet) within 10 ft. The venting system shall terminate at least 12-in. from any air opening into any building. The bottom of the vent shall be located at least 12-in. above grade or anticipated snowline. Termination of the vent shall be not less than 7 ft above an adjacent public walkway. The vent terminal shall not be installed closer than 3 ft from the inside corner of an L shaped structure. Termination of the vent should be kept at least 3 ft away from vegetation. The venting system shall terminate at least 4 ft horizontally from, and in no case above or below, unless a 4 foot horizontal distance is maintained, from electric meters, gas meters, regulators, and relief equipment. Maintain 3 ft horizontal distance from dryer vents.

B. Installation

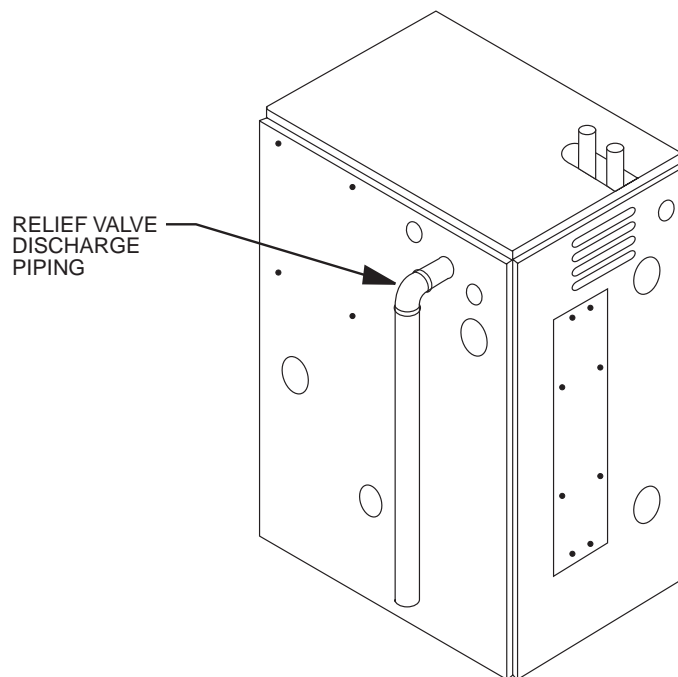
1. Attach combustion air intake piping to factory supplied Fernco 2-in. rubber coupling on mixer. Attach vent piping to factory supplied 2-in. CPVC vent tee on draft inducer outlet.

NOTE: All pipe joints are to be water tight.

2. Working from the boiler to the outside, cut pipe to required length(s).
3. Deburr inside and outside of pipe.
4. Chamfer outside edge of pipe for better distribution of primer and cement.
5. Clean and dry all surfaces to be joined.
6. Check dry fit of pipe and mark insertion depth on pipe.

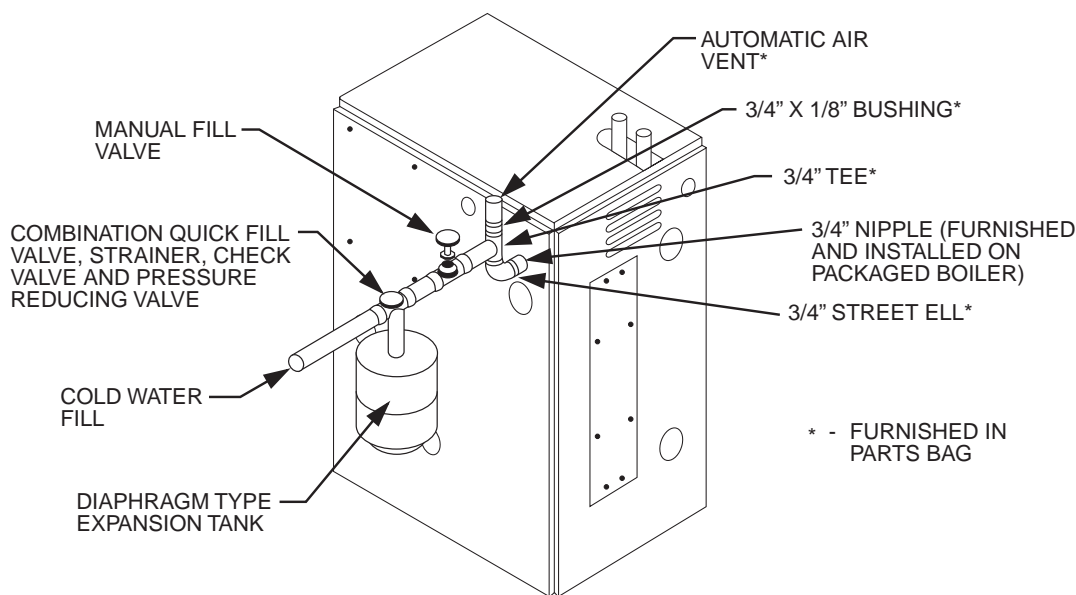
NOTE: It is recommended that all pipes be cut, prepared, and pre-assembled before permanently cementing any joint.

7. After pipes have been cut and pre-assembled, apply cement primer to pipe fitting socket and end of pipe to insertion mark. Quickly apply approved cement to end of pipe and fitting socket (over primer). Apply cement in light, uniform coat on the inside of socket to prevent buildup of excess cement. Apply second coat.



A99160

Fig. 6—Relief Valve Discharge Piping



A99161

Fig. 7—Diaphragm Type Expansion Tank Piping

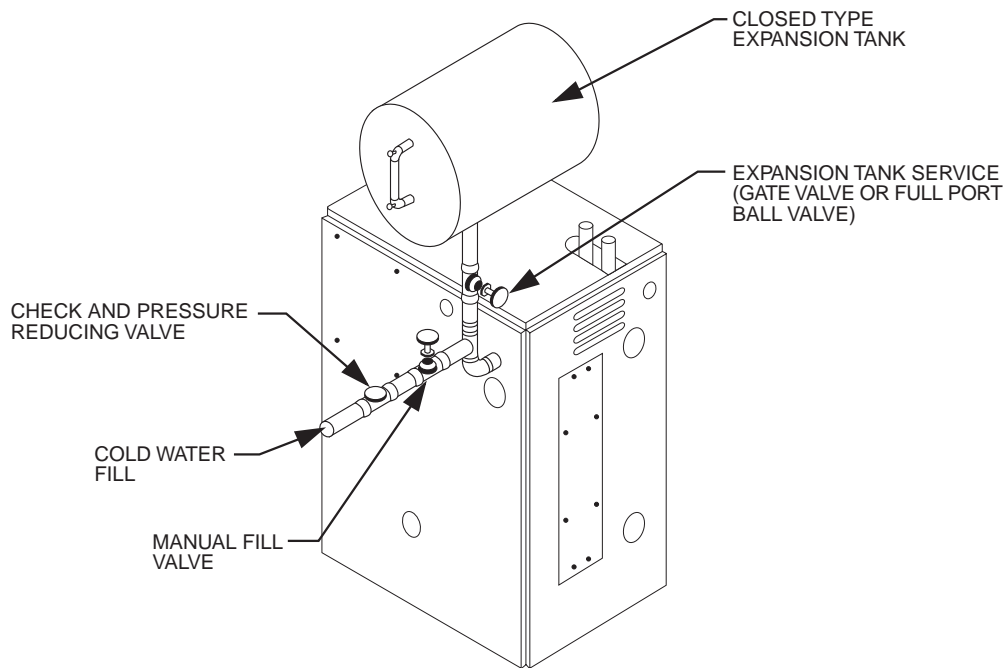
8. While cement is still wet, insert pipe into socket with a 1/4 turn twist. Be sure pipe is fully inserted into fitting socket.
9. Wipe excess cement from joint. A continuous bead of cement will be visible around perimeter of a properly made joint.
10. Handle pipe joint carefully until cement sets.
11. Support combustion air and vent piping a minimum of every 5 ft using pre-formed metal hanging straps. Do not rigidly support pipes. Allow movement due to expansion and contraction.
12. Slope combustion air and vent pipes toward boiler a minimum of 1/4-in. per linear foot with no sags between hangers.
13. Use appropriate methods to seal openings where vent and combustion air pipes pass through roof or side wall.

PROCEDURE 5—CONCENTRIC VENT INSTALLATION

NOTE: If these instructions differ from those packaged with termination kit, follow kit instructions.

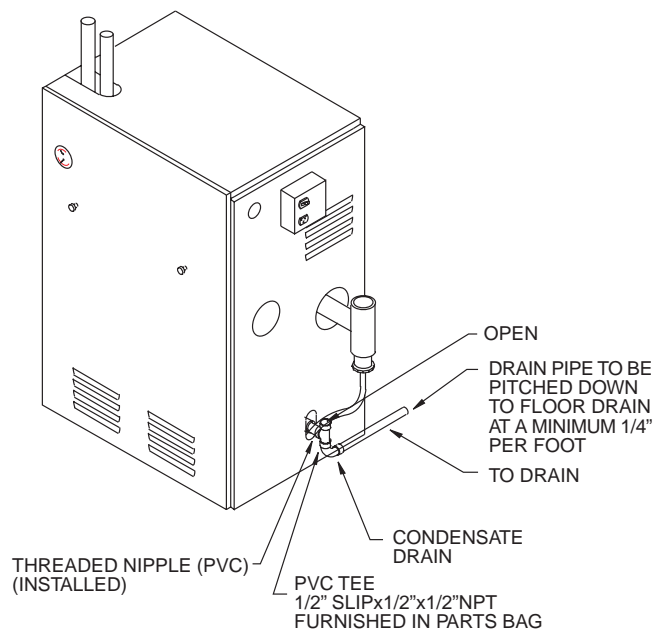
Combustion-air and vent pipes must terminate outside structure. A factory accessory termination kit must be installed in one of the installations shown in Fig. 10 or Fig. 11. Four termination kits are available.

1. The 2-in. termination bracket kit is for 1-in., 1-1/2-in., and 2-in. diameter 2-pipe termination systems (50,000 and 75,000 Btuh boilers).
2. The 3-in. termination bracket kit is for 2-1/2-in., 3-in., and 4-in. diameter 2-pipe termination systems (50,000, 75,000, and 100,000 Btuh boilers).



A99162

Fig. 8—Conventional (closed type) Expansion Tank Piping

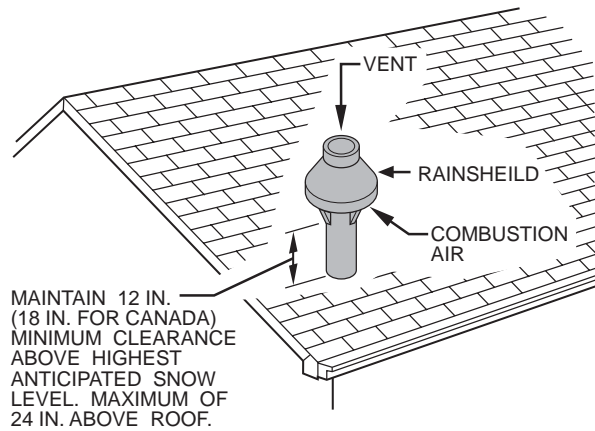


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Fig. 9—Drain Piping

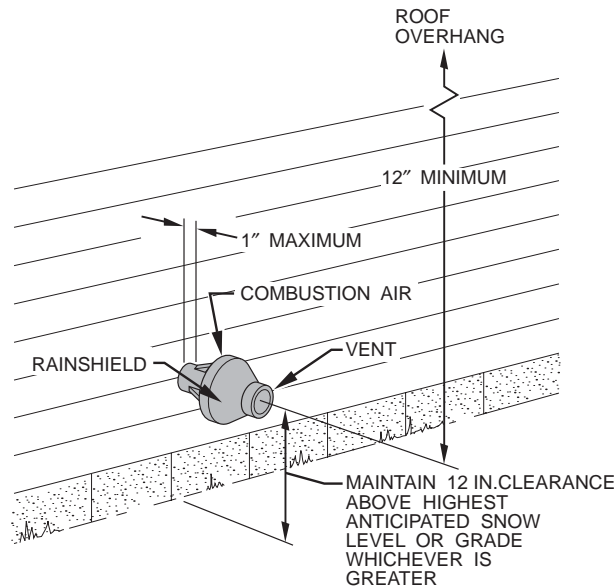
A. Concentric Vent/Air Termination Kit

1. Determine location for termination. Consideration of the following should be made when determining an appropriate location for termination kit.
 - a. Comply with all clearance requirements as stated in Procedure 4A.7.
 - b. Termination kit should be positioned so it will not damage plants/shrubs or air conditioning equipment.
 - c. Termination kit should be positioned so it will not be affected by wind eddy (such as inside building corners) or that may allow recirculation of flue gases, airborne leaves, or light snow.
 - d. Termination kit should be positioned where it will not be damaged by or subjected to foreign objects, such as stones, balls, etc.
 - e. Termination kit should be positioned where vent vapors are not objectionable.
2. Cut one 4-in. diameter hole for 2-in. kit, or one 5-in. diameter hole for 3-in. kit.
3. Loosely assemble concentric vent/air termination components together using instructions in kit.
4. Slide assembled kit with rain shield REMOVED through hole.
 - a. **Roof terminations**—Locate assembly through roof to appropriate height as shown in Fig. 10.



A01381

Fig. 10—Concentric Vent and Combustion-Air Roof Termination



A01382

Fig. 11—Concentric Vent and Combustion-Air Side Termination

Table 5—BW9 Vent Table

MODEL	VENT DIAMETER	MINIMUM LENGTH	MAXIMUM LENGTH OF PIPE PER NUMBER OF ELBOWS						
			Number of 90 Degree Elbows						
			0	1	2	3	4	5	6
BW9-100	2-in.	7 ft	16 ft	14-1/2 ft	13 ft	11-1/2 ft	10 ft	8-1/2 ft	7 ft
	3-in.	15 ft	83 ft	80 ft	77 ft	74 ft	71 ft	68 ft	65 ft
BW9-075	2-in.	7 ft	21-1/2 ft	20 ft	18-1/2 ft	17 ft	15-1/2 ft	14 ft	13-1/2 ft
	3-in.	20 ft	97 ft	94 ft	91 ft	89 ft	86 ft	83 ft	80 ft
BW9-050	2-in.	7 ft	21-1/2 ft	20 ft	18-1/2 ft	17 ft	15-1/2 ft	14 ft	14 ft
	3-in.	20 ft	97 ft	94 ft	91 ft	89 ft	86 ft	83 ft	80 ft

- Vent pipe lengths include the first five (5) feet of factory-supplied CPVC.
- Do not use more than size (6) elbows plus termination elbows.
- Length of pipe is measured from the side of the boiler jacket or the exhaust vent tee.
- (2) 45° elbows count as one 90° elbow.
- Long radius elbows are recommended.
- Any field supplied vent fittings used with 5 ft of factory-supplied CPVC must be same grade of CPVC.

- Sidewall terminations**—Locate assembly through sidewall with rain shield positioned no more than 1-in. from wall as shown in Fig. 11.

NOTE: Do not allow insulation or other materials to accumulate inside of pipe assembly when installing it through hole.

NOTE: For any additional questions concerning the Concentric Vent Kit, consult kit installation instructions.

- Disassemble loose pipe fittings. Clean and cement using same procedures as used for system piping.
- Check required dimensions as shown in Fig. 10 and 11.

Table 6—Combustion-Air and Vent Pipe Termination Clearances

LOCATION	CLEARANCE (FT)	
	U.S.A.	Canada
Above grade level or above anticipated snow depth	1	1†
Dryer/Water heater vent	See Note 5	See Note 5
From plumbing vent stack	3	3
From any mechanical fresh air intake	See Note 4	See Note 6
For furnaces with an input capacity 100,000 Btuh or less—from any non-mechanical air supply (windows or doors which can be opened) or combustion-air opening	1	1
For furnaces with an input capacity greater than 100,000 Btuh—from any non-mechanical air supply (windows or doors which can be opened) or combustion-air opening	1	3
From service regulator vent, electric and gas meters, and relief equipment	See Note 6	See Note 6
Above grade when adjacent to public walkway	See Note 3	See Note 3

† 18 in. above roof surface in Canada.

NOTES: 1. If installing 2 adjacent Furnaces, refer to Multiventing and Vent Terminations section for proper vent configurations.

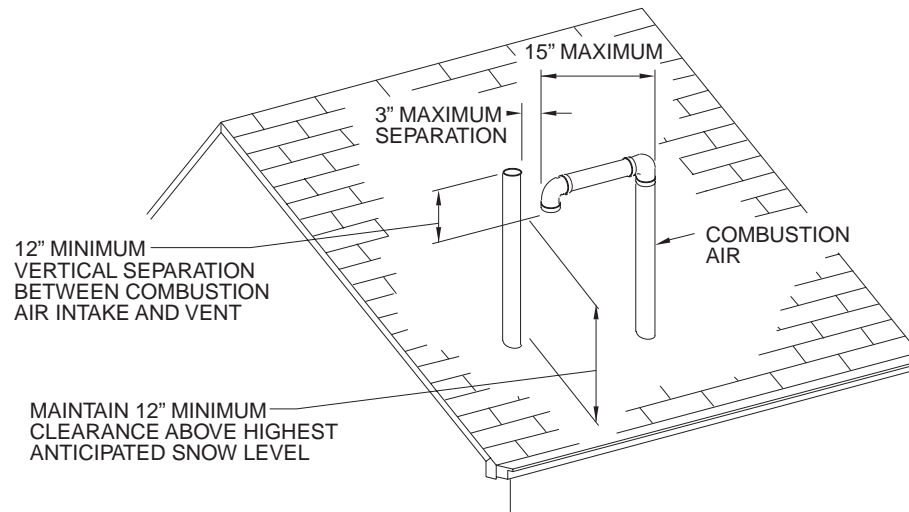
2. When locating combustion-air and vent terminations, consideration must be given to prevailing winds, location, and other conditions which may cause recirculation of the appliance's own flue products or the flue products of adjacent vents. Recirculation can cause poor combustion, inlet condensate problems, and accelerated corrosion of heat exchangers.

3. Vent termination can not terminate less than 2 ft horizontal and 7 ft above public walkway or where condensate vapor or droplets may be a hazard.

4. Vent termination must be at least 3 feet above any forced draft inlets within 10 feet horizontal. Vent termination must be at least 3 feet horizontal from other direct vent appliances intake unless otherwise specified by manufacturer.

5. 3 ft radius of furnace air-intake terminal and 1 ft horizontally from vertical centerline of furnace air-intake terminal.

6. Above a meter/regulator within 3 feet horizontally of vertical centerline of meter/regulator vent outlet to a maximum vertical distance of 15 ft.



A99164

Fig. 12—Roof Vent/Intake Terminations

PROCEDURE 6—GAS SUPPLY PIPING

The gas pipe to your boiler must be the correct size for the length of run and for the total BTU per hour input of all gas utilization equipment connected to it. See Table 7 for the proper size. Be sure your gas line complies with local codes and gas company requirements.

The boiler and its individual shutoff valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of 1/2 psig (3.5kPa).

The boiler must be isolated from the gas supply piping system by closing its individual manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 psig (3.5kPa).

→ The **MAXIMUM GAS SUPPLY PRESSURE** for NATURAL gas is 11.0-in.w.c. The **MINIMUM GAS SUPPLY PRESSURE** for NATURAL gas is 5.0-in. w.c. (See Table 8.)

→ The **MAXIMUM GAS SUPPLY PRESSURE** for PROPANE is 14.0-in.w.c. The **MINIMUM GAS SUPPLY PRESSURE** for PROPANE is 10.0-in.w.c. (See Table 8.)

NOTE: Gas pressures at or below the minimum gas supply pressures may result in nuisance ignition lock-outs or poor operational performance.

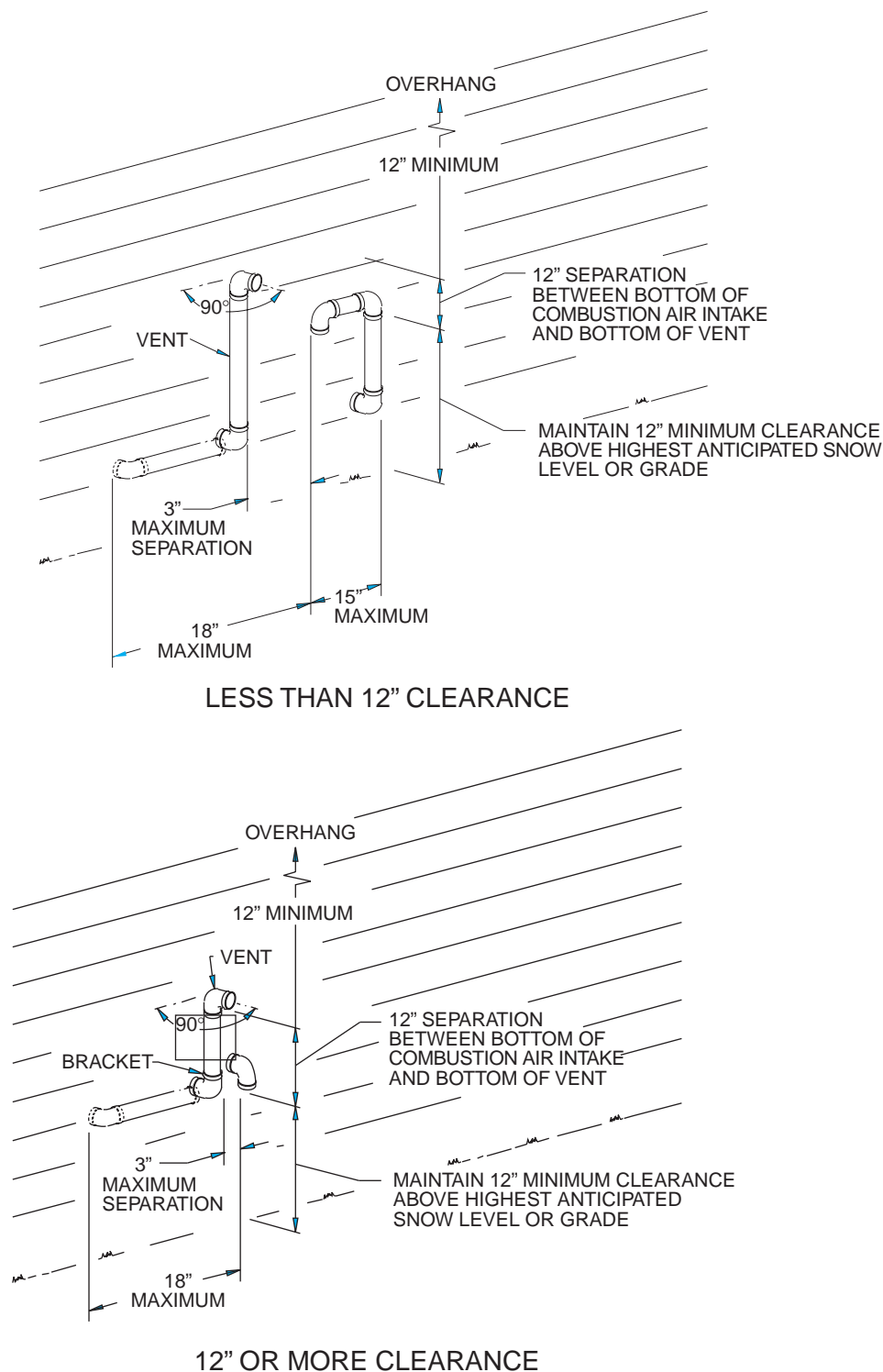
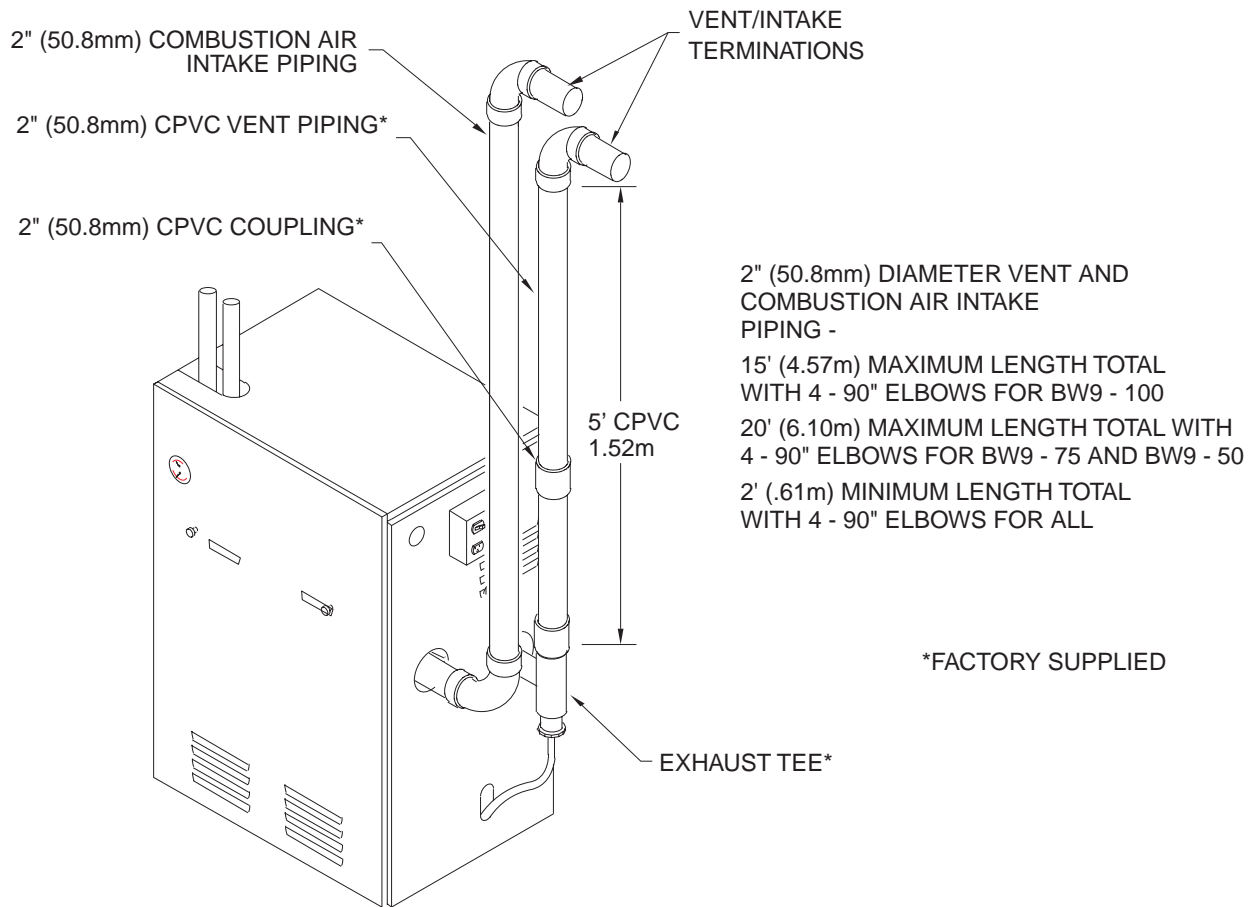


Fig. 13—Sidewall Vent/Intake Terminations

A. Connecting the Gas Piping

Refer to Fig.16 for the general layout at the boiler. It shows the basic fittings you will need. The gas line enters the boiler from the right side jacket panel. The boiler may receive the gas supply pipe through the left side, or rear jacket panel by relocating the gas valve connector and pipe assembly. The boiler is equipped with a 1/2-in. NPT connection on the gas valve for supply piping. The following rules apply:

1. Use only those piping materials and joining methods listed as acceptable by the authority having jurisdiction, or in the absence of such requirements, by the National Fuel Gas Code, NFPA-54-2002/ANSI Z223.1-2002. In Canada, follow the CAN/CGA B149.1 and .2 installation Codes for Gas Burning Appliances and Equipment.
2. Use pipe joint compound suitable for propane gas on male threads only.
3. Use ground joint unions.
4. Install a sediment trap upstream of gas controls.



A00310

Fig. 14—Combustion Air & Vent (2-in.)

5. Use 2 pipe wrenches when making the connection to the gas valve to keep it from turning.
6. Install a manual shutoff valve in the vertical pipe about 5 ft above floor.
7. Tighten all joints securely.
8. Propane gas connections should only be made by a licensed propane installer.
9. Two stage regulation should be used by the propane installer.
10. Propane gas piping should be checked out by the propane installer.

B. Checking the Gas Piping

After all connections have been made, check immediately for leaks. Open the manual shutoff valve. Test for leaks by applying soap suds (or a liquid detergent) to each joint. Bubbles forming indicate leak. **CORRECT EVEN THE SMALLEST LEAK AT ONCE.**

⚠ WARNING: Never use a match or open flame to test for leaks. Failure to do so could result in personal injury or death.

The length of pipe or tubing should be measured from the gas meter or propane second stage regulator.

PROCEDURE 7—ELECTRICAL WIRING

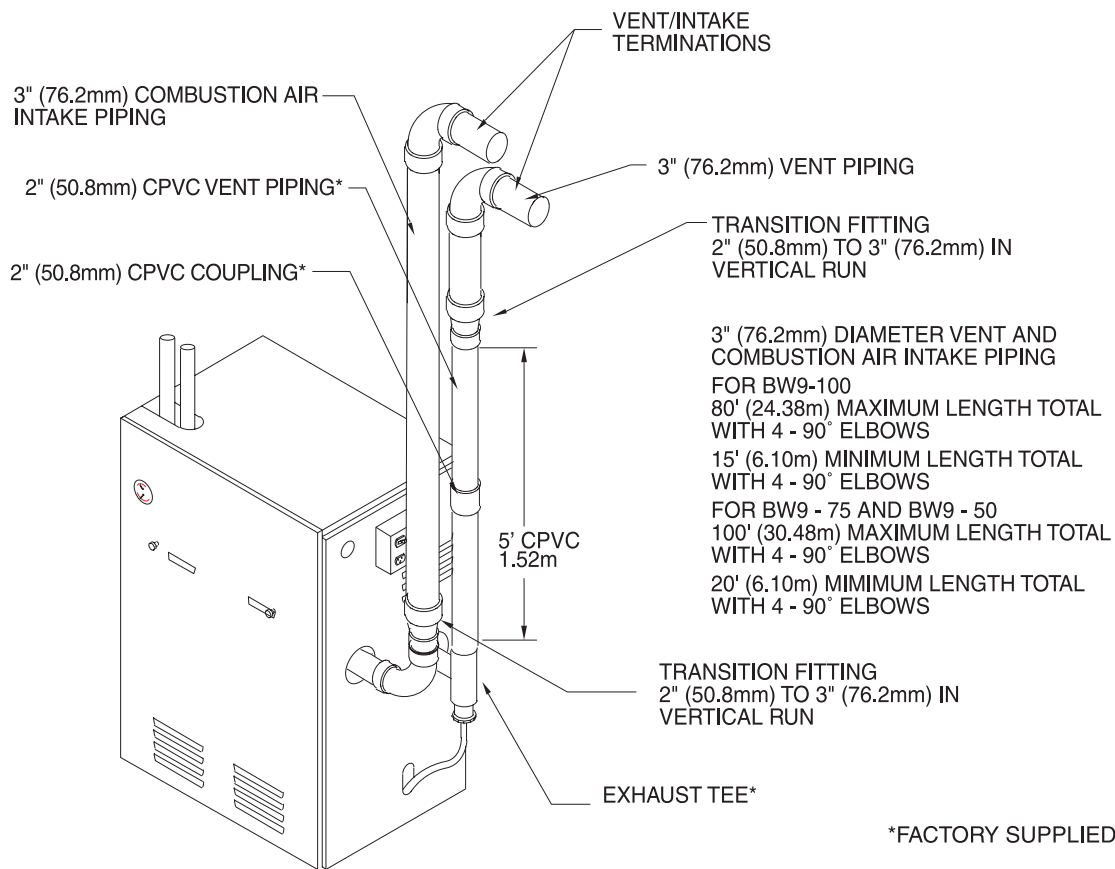
⚠ WARNING: Turn off electrical power at fuse box before making any line voltage connections. Follow local electrical codes. Failure to follow this warning could result in electrical shock, personal injury or death.

⚠ CAUTION: Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. Verify proper operation after servicing.

All electrical work must conform to local codes as well as the National Electrical Code, ANSI/NFPA 70. In Canada, electrical wiring shall comply with the Canadian Electrical Codes, CSA C22.1 and .2.

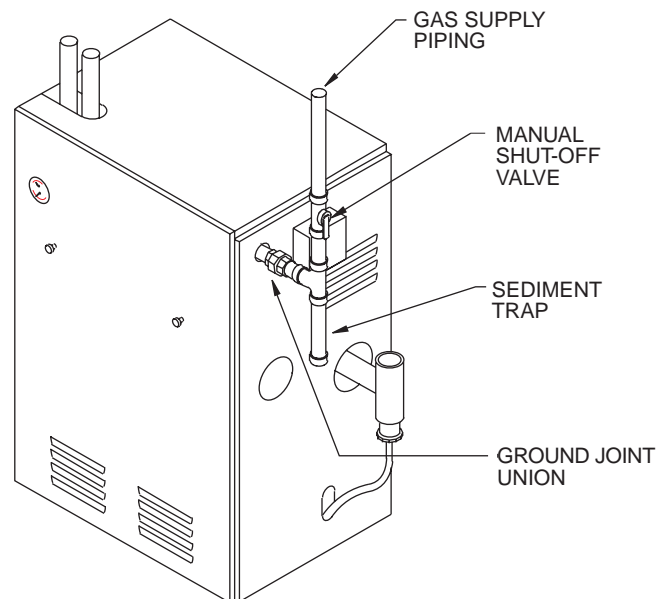
A. Electrical Power Supply

Prior to making any line voltage connections, service switch at boiler should be in the off position and the power turned off at the fuse box. Run a separate 120 volt circuit from a separate over current protection device in the electrical service entrance panel. This should be a 15-amp circuit. A service switch has been pre-wired and located on the exterior boiler jacket. See Fig. 17 for diagram showing location of service switch junction box and power supply connection points. Connect black (hot) lead from the power supply to either of the unused brass screws on the service switch. Connect the white (neutral) lead from the power supply to the white screw on the service switch. Connect the green (ground) lead from the power supply to the ground (green) screw on the service switch. The receptacle on the service switch is always powered regardless of whether the switch is on or off, and could be used as a power supply for an external condensate pump if one is used.



A00311

Fig. 15—Combustion Air & Vent (3-in.)



A99167

Fig. 16—Gas Piping

The boiler, when installed, must be electrically grounded in accordance with the requirements of the authority having jurisdiction or, in the absence of such requirements, with the National Electrical Code, ANSI/NFPA 70. In Canada, electrical wiring shall comply with the Canadian Electrical Codes, CSA C22.1 and .2.

Run a 14 gauge or heavier copper wire from the boiler to a grounded connection in the service panel or a properly driven and electrically grounded ground rod.

Table 7—Gas Pipe Size

NATURAL GAS				
Length of Pipe — Ft.	Pipe Capacity — Btuh Input (Includes Fittings)			
	1/2 in.*	3/4 in.*	1 in.	1–1/4 in.
20	92,000	190,000	350,000	625,000
40	63,000	130,000	245,000	445,000
60	50,000	105,000	195,000	365,000
PROPANE GAS				
Length of Pipe — Ft.	Copper Tubing		Iron Pipe	
	5/8 in.*	3/4 in.*	1/2 in.*	3/4 in.*
20	131,000	216,000	189,000	393,000
40	90,000	145,000	129,000	267,000
60	72,000	121,000	103,000	217,000

* Outside diameter

Table 8—BW9 Gas Supply Pressures

	NATURAL	PROPANE
Maximum Gas Supply Pressure	10-in. w.c.	14-in. w.c.
Recommended Gas Supply Pressure	7-in. w.c.	11-in. w.c.
Minimum Gas Supply Pressure	5-in. w.c.	10-in. w.c.

B. Install Your Thermostat

The thermostat location has an important effect on the operation of your boiler system. **BE SURE TO FOLLOW THE INSTRUCTIONS INCLUDED WITH YOUR THERMOSTAT.**

Locate the thermostat about 5 ft above the floor on an inside wall. It may be mounted directly on the wall or on a vertical mounted outlet box. It should be sensing average room temperature. Avoid the following:

DEAD SPOTS: behind doors corners and alcoves.

HOT SPOTS: concealed pipes, fireplaces, TV sets, radios, lamps, direct sunlight, and kitchens.

COLD SPOTS: concealed pipes or ducts, unheated rooms on other side of wall, and stairwells - drafts.

Set heat anticipator at 0.7 amps. Connect 24 volt thermostat leads to the 2 yellow wires located in service switch junction box, located on outer jacket of boiler. See Fig. 17 for service switch junction box and thermostat field wiring connections.

C. Connect Circulator Pump Wiring

→ See Fig. 17 for service switch junction box and circulator pump field wiring connections. A 5 ft wiring harness with flexible metal conduit is supplied to connect the circulator pump to the service switch junction box. If the two 120 volt circulator wire terminals inside the junction box are not used, please leave the 2 wire nuts installed on black and white leads to prevent the short circuit.

⚠ CAUTION: Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. Verify proper operation after servicing.

PROCEDURE 8—CONTROLS AND ACCESSORIES

This section provides a brief description of the key controls and accessories found in the BW9 boiler.

See the Troubleshooting section of the Service Hints chapter of this installation manual for detailed sequences of operation and troubleshooting procedures. See the Repair Parts chapter of this manual for locations of all control components and accessories described.

A. Intergrated Boiler Control (IBC)

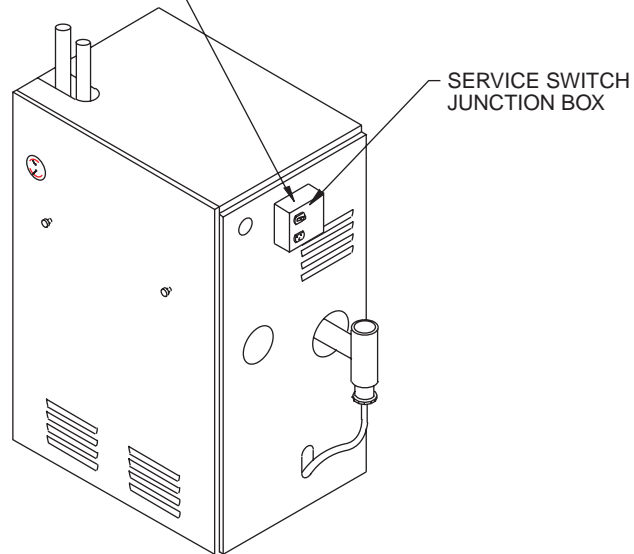
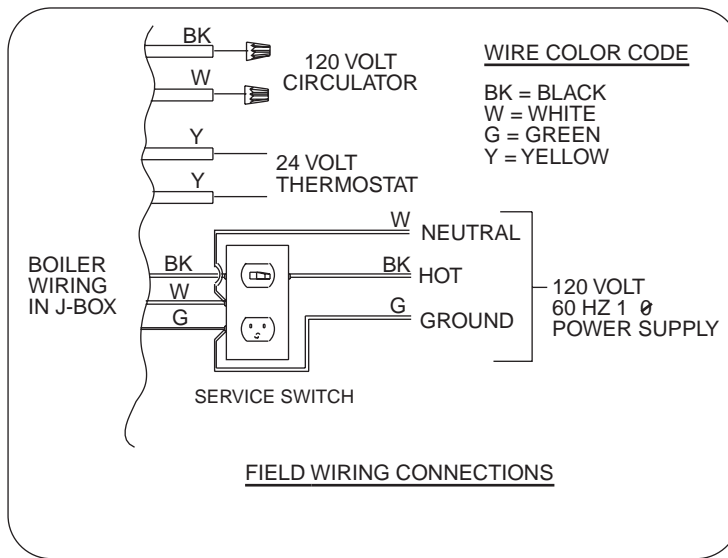
The Integrated Boiler Control (IBC) is a microprocessor based controller for a high efficiency gas boiler that monitors all safety controls and which controls the operation of the combustion air blower, circulator pump, burner, and a combination hot surface igniter/flame sensor. This controller is not intended for use with a vent damper. This controller is mounted on the control panel inside of the boiler and contains 5 diagnostic indicator lights.

B. Gas Control Valve

The electrically controlled 24 Volt Honeywell Model VR8205 Combination Gas Control Valve is designed to meet the requirements for use with hot surface ignition systems found in the BW9. The valve is piped to the gas/air mixer.

C. Hot Surface Igniter

The 120 volt Hot Surface Igniter heats up to 1800°F to initiate combustion of the gas in the BW9 burner. The igniter is mounted next to the burner through the gas/air mixer. The igniter also serves as a means for proving the main burner flame by flame rectification. In the event of a lack of flame signal on 3 consecutive trials for ignition, the IBC will lockout. The "VALVE" diagnostic indicator lamp (lamp "D" on the IBC, See Fig. 21) will blink indicating the failure mode as a lack of flame signal. The IBC is manually reset from lockout by either removing and reestablishing the thermostat's call for heat, or by turning the service switch off, then back on.



A99168

Fig. 17—Field Wiring Connections

D. L4006A High Limit Aquastat Control

The High Limit Aquastat Control determines the maximum boiler water temperature and also provides a means for protecting the boiler and heating system from unsafe operating conditions which could damage the boiler. The aquastat is mounted in the 1/2-in. NPT control well and 3/4-in.x 1/2-in.bushing on the top of the front boiler section at the hot water outlet. The aquastat is tied in with the IBC and is factory set at 100°F water temperature. The high limit setpoint is field adjustable and may be set anywhere between 100°F and 200°F. The field setpoint adjustment for each installation depends on heating system requirements. The aquastat automatically resets when the boiler water temperature decreases (5–30°F adjustable differential). The differential can be adjusted with the (white) Differential Adjustment Wheel on the aquastat and gives the flexibility for boiler operation. The larger the differential, the longer the run cycle of the boiler.

NOTE: The maximum setpoint of the Aquastat must not exceed 200°F.

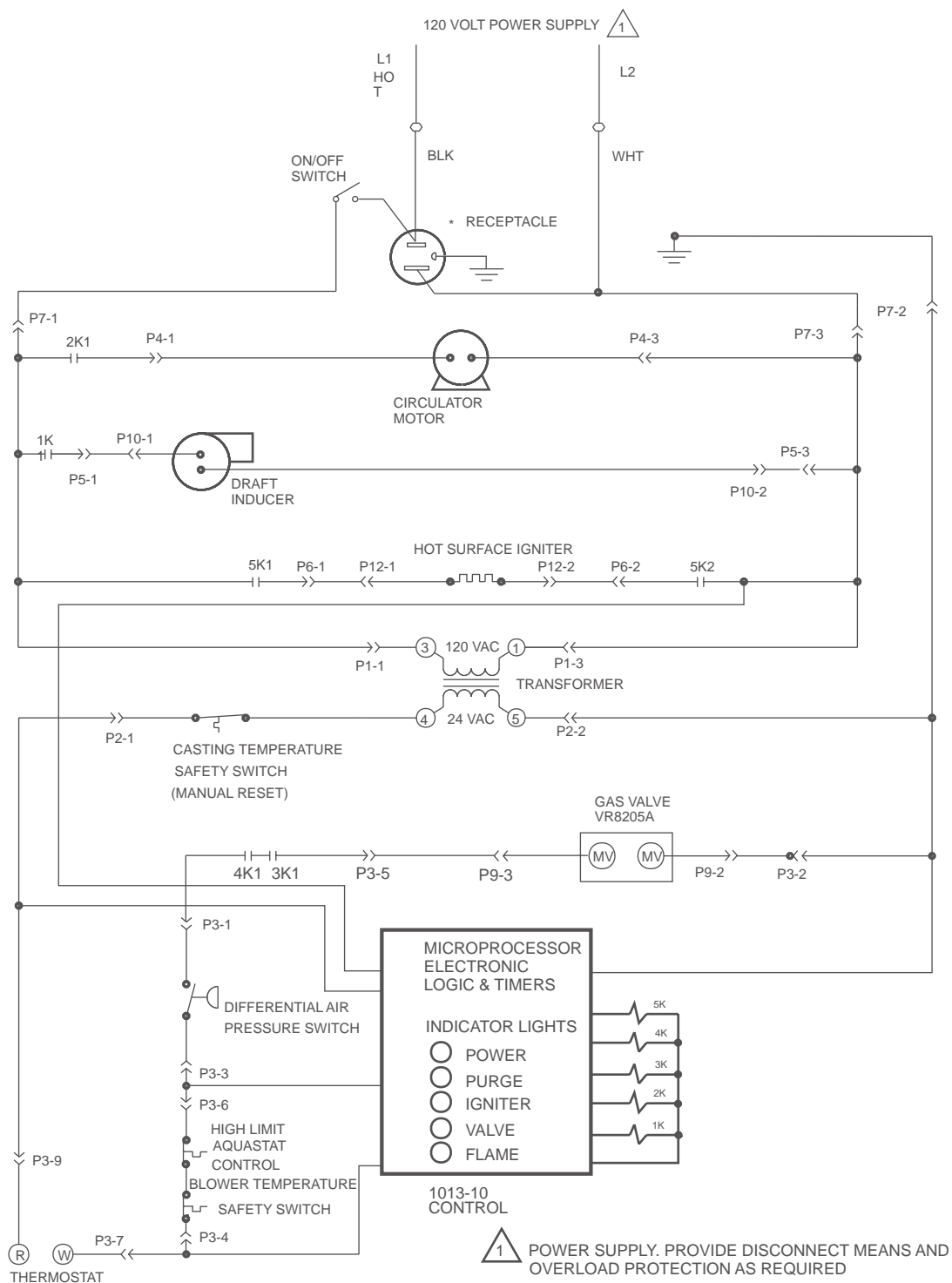


Fig. 19—Ladder Wiring Diagram

E. Draft Inducer Temperature Safety Switch

The Draft Inducer Temperature Safety Switch is a disc thermostat (180°F setpoint) located on the induced draft fan outlet port. The switch protects the inducer and vent pipe from a potential high temperature condition for the discharging flue gases. This condition would typically be a result of higher aquastat setting or over-firing. The temperature safety switch automatically resets when the vent temperature decreases. (15°F switch differential).

 **WARNING:** Never run cold water into a hot empty boiler. The boiler will be damaged and/or serious bodily injury may result.

F. Casting Temperature Safety Switch

In the event of lack of or loss of water in the boiler, the Casting Temperature Safety Switch (300°F setpoint) installed on the top of the aluminum boiler section shuts off the boiler by shutting off power to the Integrated Boiler Control (IBC) and causes the Power Indicator Light to go out. This fault requires manual reset of the casting temperature safety switch to restart the boiler. Verify that the boiler is properly filled with water before resetting this switch.

G. Differential Pressure Air Proving Switch

→ The diaphragm type differential pressure switch is connected by vinyl tubing to the pressure signal hose adapters. The pressure switch monitors air flow by sensing the differential pressure measured in inches of water (in. w.c.). The factory settings on these switches are 1.00-in.w.c. for BW9-100, 1.35-in. w.c. for BW9-75 and 1.55-in. w.c. for BW9-50. The contacts are normally open, and close when the draft inducer is running and causing the differential pressure at the switch to exceed the setting. The closed switch proves there is adequate air flow for combustion. The pressure switch shuts off the main burner if the differential pressure is inadequate due to a blocked vent pipe or a blocked air intake or blocked boiler sections or blocked draft inducer. After 5 minutes of lack of adequate differential pressure, the IBC will lockout. The "PURGE" indicator light will blink, indicating a failure to prove adequate combustion air flow or flue gas flow. The IBC is manually reset from lockout as described in the Sequence of Operation section of this chapter.

H. Draft Inducer

The draft inducer (blower) provides a means for pulling combustion air into and through the mixer, the burner, the flue ways of the cast aluminum boiler sections and the flue adapter before being discharged through the vent piping to the outdoors. See applicable sections for proper sizing and installation of combustion air and vent piping in this manual.

I. Circulator Pump

Every forced hot water system requires at least one circulating pump. The circulating pump imparts the necessary energy to move the water through the closed loop supply and return piping systems, terminal heating equipment (i.e. finned tube radiators, etc.) and back through the boiler for reheating. To provide the required hot water flow rates, the circulator pump must be properly sized to overcome frictional losses (usually measured in feet of water, also referred to as "pump head loss") of the supply and return piping systems and boiler. The circulator pump is furnished in a carton within the boiler cabinet for a single zone or zone valve controlled heating system and should be correctly located on the downstream (i.e., pumping away) side of the expansion tank. For a pump controlled system (where there is a circulator for each zone) the circulator provided with the boiler can work for one zone. For more details on piping and circulators, see Near Boiler Piping section of this manual.

J. Drain Valve

The manual drain valve provides a means of draining the water in the heating system, including the boiler and hot water supply and return piping systems installed above the drain valve. This drain valve is installed in the 3/4-in. tapping at the bottom of the front boiler section. Any piping installed below the elevation of this drain valve will require additional drain valves to be installed at low points in the piping systems in order to drain the entire system.

K. ASME Rated Pressure Relief Valve

Each boiler must have a properly sized and installed ASME rated pressure relief valve. Water expands as it is heated by the burner/boiler sections. If there is no place for the water to expand its volume, (i.e. a properly sized and properly functioning expansion tank) pressure on the inside of the boiler and heating system will increase. The furnished relief valve will automatically open at 30 psig pressure to relieve the strain on the boiler and heating system from the increasing pressure. The pressure relief valve discharge must be piped with piping same size as the valve discharge opening to an open drain, tub or sink, or other suitable drainage point not subject to freezing, in accordance with ASME specifications.

 **WARNING:** Failure to provide the pressure relief valve with piping as herein described may cause water damage and/or serious bodily injury. The boiler manufacturer is not responsible for any water damage or personal injury.

L. Flame Rollout Safety Shutoff

As required, this boiler is equipped with a manual reset flame rollout safety shutoff means, which shuts off main burner gas in the event that the flow of combustion products through the flueways is reduced. In the event of blocked flueways, enough air will not be available to support combustion, and the Integrated Boiler Control (IBC) will lockout due to loss of adequate air flow (after 3 trials for ignition). The "PURGE" diagnostic indicator lamp (lamp 'B' on the IBC, see Fig. 21) will blink indicating the failure mode as a lack of adequate air flow. The IBC is manually reset from lockout by either removing and re-establishing the thermostat's call for heat, or by turning the service switch off, then back on. If the boiler cannot be restored to normal operating condition by resetting the control, contact a qualified service agency to check heat exchanger flueways for blockage.

M. (Optional) External Condensate Pump

For installations where there is no floor drain or other appropriate drainage receptacle available to receive net condensate overflow from the boiler, an external float activated condensate pump with integral sump is required. This unit can be installed to pump the condensate to a remote tie in point to a sanitary sewer system. For this application, the boiler must be installed so that proper pitch of piping to the external condensate reservoir (sump) can be accomplished. Use wood frame or blocks to raise boiler as required for proper installation.

START-UP PROCEDURES

PROCEDURE 1—WATER TREATMENT AND FREEZE PROTECTION

1. When filling the boiler and heating system, water treatment is generally not required or desired. For localities where the water is unusually hard (above 7 grains hardness) or for low pH water conditions (below 7.0), consult a local water treatment specialist.
 - a. This boiler is designed for use in a closed hydronic heating system ONLY!
 - b. Excessive feeding of fresh make-up water to the boiler may lead to premature failure of the boiler sections.
2. Use clean fresh tap water for initial fill and make-up of boiler.
 - a. A sand filter must be used if fill and make-up water from a well is to be used.
 - b. Consideration should be given to cleaning the heating system, particularly in retrofit situations, where a new boiler is being installed in an older piping system.
 - c. In older systems, obviously discolored, murky, or dirty water, or a pH reading below 7, are indications that the system should be cleaned.
 - d. A pH reading between 7 and 8 is preferred.
3. Antifreeze if needed, must be of a type specifically designed for use in closed hydronic heating systems and with aluminum.
 - a. Choice and use of antifreeze must be in accordance with local plumbing codes.
 - b. Only INTERCOOL NFP-50 is approved for use. INTERCOOL NFP-50 is available from Interstate Chemical Company.
 - (1.) Use of any antifreeze other than INTERCOOL NFP-50 will void warranty.
 - (2.) Antifreeze must be maintained per manufacturer's specifications. Failure to do so will result in the warranty being voided.
 - c. Do not use automotive antifreeze as the type of corrosion inhibitors used will coat the boiler's heat transfer surfaces and greatly reduce capacity and efficiency.
 - d. Consult antifreeze manufacturer's literature for compatibility of antifreeze with aluminum boiler. Some brands have corrosion inhibitors that break down more rapidly or become ineffective at higher operating temperatures when used with aluminum. Follow the antifreeze manufacturers instructions on determining the proper ratio of antifreeze to water for the expected low temperature conditions, and for maintaining the quality of the antifreeze solution from year to year.
 - e. Use of antifreeze in any boiler will reduce capacity by as much as 10 to 20 percent, due to differing heat transfer and pumping characteristics. This must be taken into consideration when sizing the heating system, pump(s), and expansion tank. Consult antifreeze manufacturer's literature for specific information on reduced capacity.
 - f. Water content of the boiler is 2.6 gallons. (10 liters)

PROCEDURE 2—FILLING BOILER WITH WATER AND PURGING AIR FOR SYSTEMS WITH DIAPHRAGM TYPE EXTENSION TANKS

Refer to appropriate "Near Boiling Piping" diagrams.

1. Close all zone service valves on the supply and return piping. Open the feed valve and fill boiler with water. Make sure air vent is open. Hold relief valve open until water runs air free for 5 sec to rapidly bleed air from boiler, then let the relief valve snap shut.
2. Open the zone service valve on the supply pipe for the first zone. Open the purge valve on the first zone. Feed water will fill the zone, pushing air out the purge valve. Close the purge valve when the water runs air free. Close the zone service valve.
3. Repeat step 2 for all remaining zones.
4. Open all service valves. Any air remaining trapped in the return lines between the service valves and the boiler will be pushed towards the air vent when the boiler is placed in operation.
5. Inspect piping system. Repair any leaks immediately.

PROCEDURE 3—FILLING BOILER WITH WATER AND PURGING AIR WITH CONVENTIONAL CLOSED TYPE EXPANSION TANKS

Refer to appropriate "Near Boiling Piping" diagrams.

1. Close all zone service valves on the supply and return piping and close the expansion tank service valve. Drain expansion tank. Open the feed valve and fill boiler with water. Hold relief valve open until water runs air free for five sec to rapidly bleed air from boiler, then let the relief valve snap shut.
2. Open the zone service valve on the supply pipe for the first zone. Open the purge valve on the first zone. Feed water will fill the zone, pushing air out the purge valve. Close the purge valve when the water runs air free. Close the zone service valve.
3. Repeat step 2 for all remaining zones.
4. Open the expansion tank service valve and the tank vent. Fill the tank to the proper level and close the tank vent. Remove the handle from the expansion tank service valve so the homeowner doesn't accidentally close it.
5. Open all service valves. Any air remaining trapped in the return lines between the service valves and the boiler will be pushed towards the expansion tank when the boiler is placed in operation.
6. Inspect piping system. Repair any leaks immediately.

NOTE: DO NOT use stop leak compounds. Leaks in threaded connections in the aluminum boiler sections must be repaired immediately. Aluminum threads will not seal themselves.

PROCEDURE 4—PLACING BOILER IN OPERATION

Safe lighting and other performance criteria are met with the gas manifold and control assembly provided on the boiler per tests specified in ANSI Z21.13-latest revision. Refer to the Operating Label on the equipment. (See Fig. 20.)

FOR YOUR SAFETY READ BEFORE OPERATING

WARNING: If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

A. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.

B. **BEFORE OPERATING** smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

WHAT TO DO IF YOU SMELL GAS

- Do not try to light any appliance.
- Do not touch any electric switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.

- If you cannot reach your gas supplier, call the fire department.

C. Use only your hand to turn the gas control knob. Never use tools. If the knob will not turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.

D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

OPERATING INSTRUCTIONS

1. STOP! Read the safety information above on this label.
2. Set the thermostat to lowest setting.
3. Turn off all electric power to the appliance.
4. This appliance is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.

5. Remove the front jacket panel.
6. Turn the gas control knob clockwise ↻ to "OFF".
7. Wait five (5) minutes to clear out any gas. Then smell for gas, including near the floor. If you smell gas, STOP! Follow "B" in the safety information above on this label. If you don't smell gas, go to next step.
8. Turn the gas control knob counter clockwise ↻ to "ON"
9. Replace the front jacket panel.
10. Turn on all electric power to the appliance.
11. Set thermostat to desired setting.
12. If the appliance will not operate. Follow the instructions "To Turn Off Gas To Appliance" and call your service technician or gas supplier.

TO TURN OFF GAS TO APPLIANCE

1. Set the thermostat to lowest setting.
2. Turn off all electric power to the appliance if service is to be performed.
3. Remove the front jacket panel.

4. Turn gas control knob clockwise ↻ to "OFF". Do not force.
5. Replace the front jacket panel.

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Fig. 20—Operating Label

PROCEDURE 5—CHECK OUT PROCEDURE AND ADJUSTMENTS

A. Verify Proper Sequence of Operation

→ The sequence can be followed via the diagnostic indicator lamps on the Integrated Boiler Control (IBC) in Fig. 21 and Table 9. This is the normal sequence of operation. A more detailed sequence of operation containing potential faults can be found in the service hints section.

NOTE: DO NOT use stop leak compounds. Leaks in threaded connections in the aluminum boiler sections must be repaired immediately. Aluminum threads will not seal themselves.

B. Inspect Venting and Air Intake System

Operate the boiler and verify that all vent/air intake connections are gastight and watertight. Repair any leaks immediately.

C. Inspect Condensate Drain

Verify that all connections are watertight, and that condensate flows freely. Repair any leaks immediately.

D. Inspect System Piping

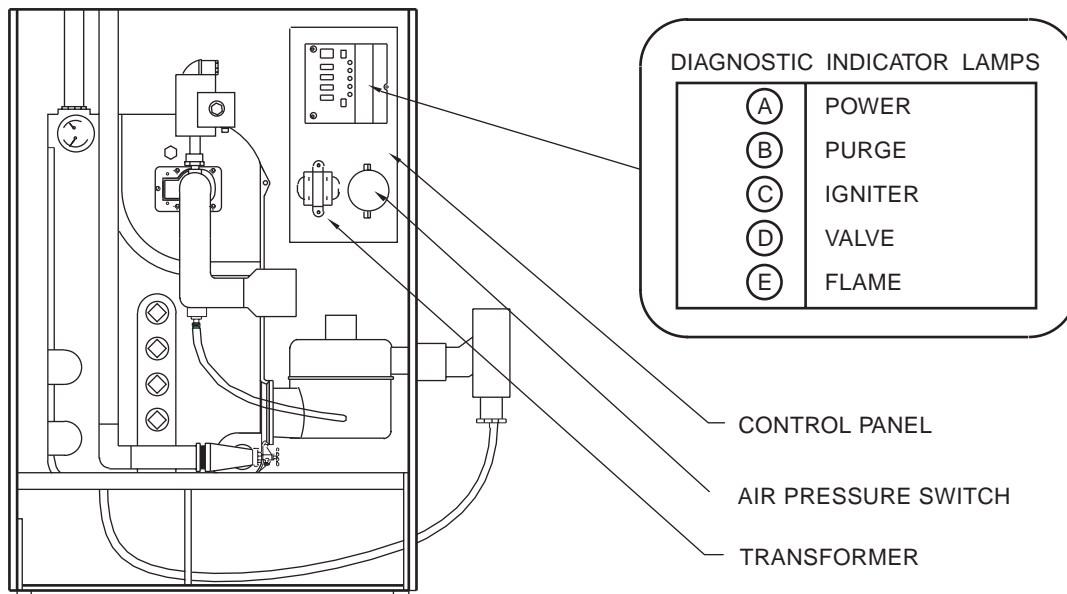
Verify that all connections are watertight. Repair any leaks immediately.

E. Test Ignition System Safety Shutoff Device

1. Turn off manual gas valve.
2. Set thermostat to call for heat.
3. Boiler begins normal sequence of operation.
4. After approximately 40 sec (pre-purge and igniter warm-up period), lamp D illuminates, indicating gas valve is powered.
5. After 6 sec, gas valve closes, lamp D goes out as integrated boiler control senses that flame is not present.
6. To restart system, follow operating instructions under "Start-up-Place in Operation".

The following steps and diagram indicate the location of the connection points required to measure the manifold pressure.

The manifold pressure may be measured using a U-tube manometer or a differential pressure gauge (Magnehelic). The diagram shows the connection of both measuring devices, but only one is required. (See Fig. 22.)



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Fig. 21—Indicator Lamps

Remove the 1/8-in. plug from the outlet pressure tap. Install the appropriate barbed fitting into the outlet pressure tap and connect the pressure side of the gauge or manometer to the barbed fitting.

→ Refer to “Measure the Gas Input Rate” in these instructions when reading manifold pressure.

When measurement is complete, disconnect gauge or manometer and remove barbed fitting. Reinstall 1/8-in. plug using the appropriate pipe sealant for use with natural gas and propane.

F. Test High Limit Control and Adjust

While burner is operating, move indicator on high limit control below actual boiler water temperature. Burner should go off while circulator continues to operate. Raise limit setting above boiler water temperature and burner should reignite after prepurge and igniter warm-up period. Set the high limit control to the design temperature requirements of the system. Maximum high limit setting is 200°F. Minimum high limit setting is 100°F.

G. Test Other Safety Controls

If the boiler is equipped with a low water cut-off, a manual reset high limit, or additional safety controls, test for operation as outlined by the control manufacturer. Burner should be operating and should go off when controls are tested. When safety controls are restored, burner should reignite.

H. Set Thermostat Heat Anticipator (If Used) and Verify Thermostat Operation

For a single thermostat connected to the yellow thermostat lead wires in the furnished field wiring junction box, the heat anticipator should be set at 0.7 amps. For other wiring configurations, refer to the instructions provided by the thermostat manufacturer regarding adjustment of heat anticipator. Cycle boiler with thermostat. Raise the thermostat to the highest setting and verify boiler goes through normal start up cycle. Lower thermostat to lowest setting and verify boiler goes off.

I. Measure the Gas Input Rate

NATURAL GAS

Correct input rate is essential for proper and efficient operation of the burner and boiler.

1. Determine elevation at installation site.
2. See Table 2 to determine the correct input rate for local elevation.
- 3. Obtain yearly average heating value of local gas supply from gas utility. At sea level elevation, it should be approximately 1000 Btu's per standard cubic foot (for natural gas only).
4. Operate boiler for 5 minutes.
5. Turn off all other gas appliances, extinguishing standing pilots where applicable.
- 6. At gas meter, measure time in sec required to use one cubic foot of gas (for natural gas only).
7. Calculate input rate for natural gas according to the following formula:

BTUH INPUT RATE =	3600 X HEATING VALUE FROM STEP 3
	time for step 6

8. Measured input rate should be within +/- 2 percent of the input rating from step 2. If within 2 percent, go to step 9. If not, adjustment is required, proceed as follows:

- a. Turn boiler off.


Table 9—Diagnostic Sequence

SEQUENCE OF OPERATION DIAGNOSTIC	DIAGNOSTIC INDICATOR LAMPS				
	A (Green)	B (Green)	C (Green)	D (Green)	E (Red)
Power ON, boiler standing by. Lamp A is illuminated indicating 24 volt power is being supplied to the integrated boiler control.	X				
Thermostat calls for heat, energizing system circulator.	X				
Integrated boiler control goes through self check of internal circuitry (1-2 sec) and energizes draft inducer.	X				
Draft inducer comes up to speed and establishes combustion airflow, causing the normally open differential pressure air proving switch contacts to close. Lamp B is illuminated indicating that combustion air-flow is proved and the 15 sec pre purge cycle is under way.	X	X			
After pre purge, Lamp B goes out and Lamp C illuminates, indicating the hot surface igniter is powered for the 20 sec igniter warm-up period. The bright yellow orange glow of the hot surface igniter can be observed through the observation port in the front boiler section just above the igniter.			X		
After igniter warm-up, the gas valve is energized, and opens on the normal firing rate regulator (2.5-in. w.c.) for a 6 sec trial for ignition. Lamp D illuminates. The blue orange glow of the burner can be seen through the observation port.	X		X	X	X
2 sec later, Lamp C goes out as power is turned off to the hot surface igniter. During the last two sec of the 6 sec trial for ignition, main burner flame is proven by flame rectification through the hot surface igniter, providing a flame signal to the integrated boiler control. The gas valve remains energized, and the boiler runs.	X			X	X
Thermostat ends call for heat, de-energizing gas valve and system circulator. Burner stops firing, and Lamp D goes out. Draft inducer remains powered. Lamp B illuminates, indicating draft inducer is running for 30 sec postpurge.	X	X			
After 30 sec, draft inducer is de-energized. Lamp B goes out. Boiler stands by for next call for heat.	X				

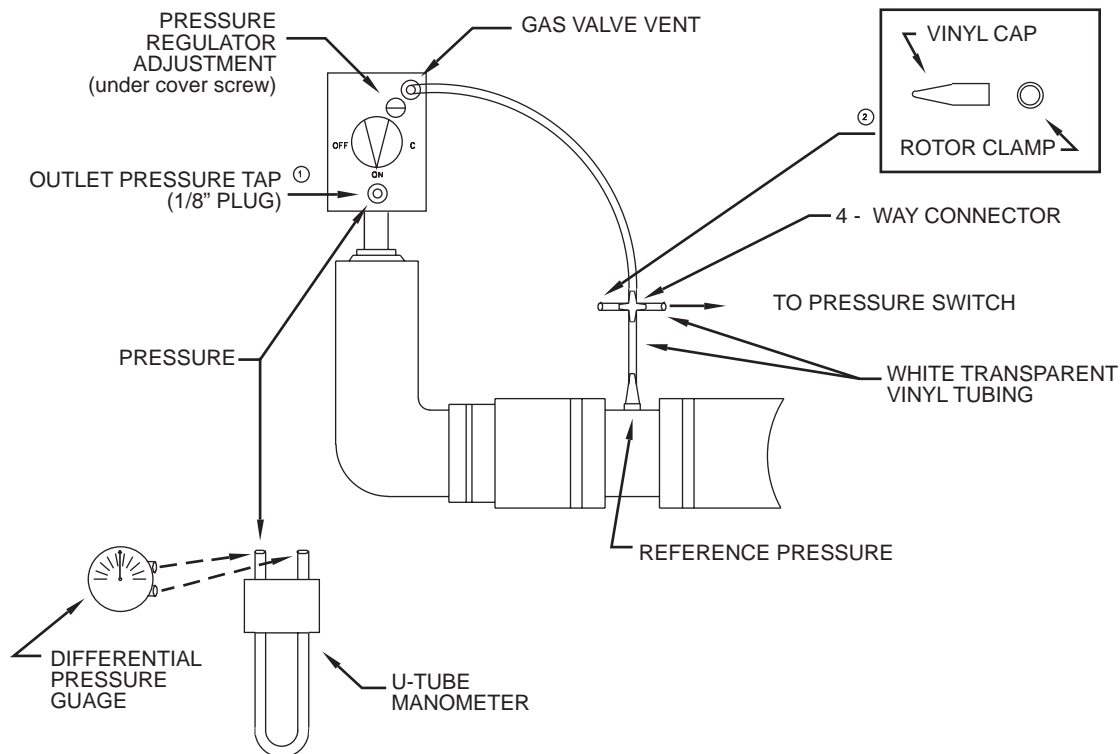
- b. Set up U-tube manometer or differential pressure gauge for measuring manifold pressure. (See Fig. 20).
- c. Manometer or gauge must be able to read at least 0.0 to 3.0-in. w.c. of differential pressure, and resolve to at least 0.1-in. w.c..
- d. Turn boiler on.
- e. Manifold pressure has been nominally set at 2.5-in. w.c. Manifold pressure and input rate must always be measured with pressure regulator cover screw installed. Cover screw must be removed for adjustment. Manifold pressure reading will change (increase) when cover screw is removed.
 - (1.) Remove regulator cover screw on top of gas valve, and insert an appropriate screwdriver into adjustment screw.
 - (2.) Turn adjustment screw clockwise to increase input rate, or counter clockwise to decrease input rate.
 - (3.) Replace cover screw, or cover hole temporarily with your finger to check new manifold pressure setting. Do not set manifold pressure lower than 2.0-in. w.c. or higher than 3.0-in. w.c. when adjusting input rate.
 - (4.) Measure new input rate (cover screw must be installed). Repeat steps 1 through 4 until the input rate is within ± 2 percent of the nameplate input rating.
 - (5.) If the actual input rate can not be set to within 2 percent of the correct input rating by adjusting manifold pressure, a change in gas orifice size is required. Consult the boiler manufacturer for information on correct orifice sizing. The specific gravity (G) and the higher heating value (HHV) of the local natural gas must be obtained from the local gas utility in order to determine the proper orifice size.
 - (6.) After adjusting input rate, turn boiler off, remove manometer or pressure gauge, reinstall 1/8-in. plug on gas valve. Turn boiler on.

→ PROPANE GAS

1. This boiler must be converted for use with propane gas. A field-supplied, factory approved accessory conversion kit must be used. A factory approved conversion kit is available from your local distributor.
2. Follow the instructions in the conversion kit.
3. Refer to Table 3 for the correct manifold pressure for the local altitude. The manifold pressure for propane gas ranges from 2.5-in.w.c. to 3.5-in.w.c. depending on the altitude.

→  **WARNING: Operating this boiler with propane gas without a factory approved conversion kit may result in equipment damage, fire, property damage, personal injury or death.**

Restore all gas appliances that may have been shut off (while measuring boiler input rate) to normal operating conditions.



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Fig. 22—Manifold Pressure Measurement Detail

J. Set Thermostat to Desired Room Temperature

Observe several operating cycles to verify proper operation.

K. Review All Instructions

Review all instructions shipped with this boiler with owner or maintenance person. Instructions must be affixed on or adjacent to the boiler.

L. Complete and Sign the Installation and Check-Out Certificate

CARE AND MAINTENANCE

NOTE: Maintenance as outlined below can be performed by the owner unless otherwise noted.

The acidic nature of flue gases condensing on the aluminum boiler sections will cause the formation of aluminum oxide. This oxide formation is normal, is generally uniform throughout the boiler sections, and represents a negligible mass of aluminum that is consumed by oxidation during the life of the boiler. If left unchecked, this buildup may eventually cause blockage of the flue gas passages in the boiler sections, reducing efficiency, and ultimately shutting down the boiler due to lack of combustion air flow. Regular service and maintenance by a qualified service agency must be performed to assure safe trouble free operation and maximum efficiency.

PROCEDURE 1—BEGINNING OF EACH HEATING SEASON

⚠ WARNING: Disconnect electrical power to unit. Turn off gas supply to unit at the gas supply shutoff. Failure to do so could result in fire, personal injury, property damage, or death.

1. Annual service call by a qualified service agency, which includes:
 - a. Examine flue passages between boiler sections, burner, and condensate lines, and clean if necessary following the annual examination and cleaning instructions in "Annual Examination and Cleaning of Boiler Components" below.
 - b. Visually inspect venting and air intake system for proper function, deterioration or leakage. If the vent or air intake show any signs of deterioration or leakage, repair or replace them immediately. Insure proper reassembly and resealing of the vent and air intake system.
 - c. Check for and remove any obstruction to the flow of combustion air or venting of flue gases. Check the air baffle located inside 1-1/2-in. X 2-in. flexible coupling on the mixer, clean it if necessary and make sure to put it back. Refer to repair parts diagram of mixer and pressure switch assembly for exact location.
 - d. Follow instructions for "Placing Boiler in Operation."
 - e. Follow instructions for "Check Out Procedure and Adjustments."
 - f. Visually inspect condensate drain line for proper operation and deterioration. Check for plugged condensate drain line.
 - g. Check the silicone rubber seals between boiler sections. Insure that there are no leaks. Use RTV silicone rubber adhesive sealant (available in caulking gun tubes) rated for at least 400°F to replace or repair seals in locations where original seals have deteriorated.
 - h. Check all gasketed joints for leakage, and tighten bolts or replace gaskets if necessary.
 - i. Remove jacket front and top panels and check for piping leaks around relief valve and other fittings. Repair, if found. DO NOT use stop leak compounds.

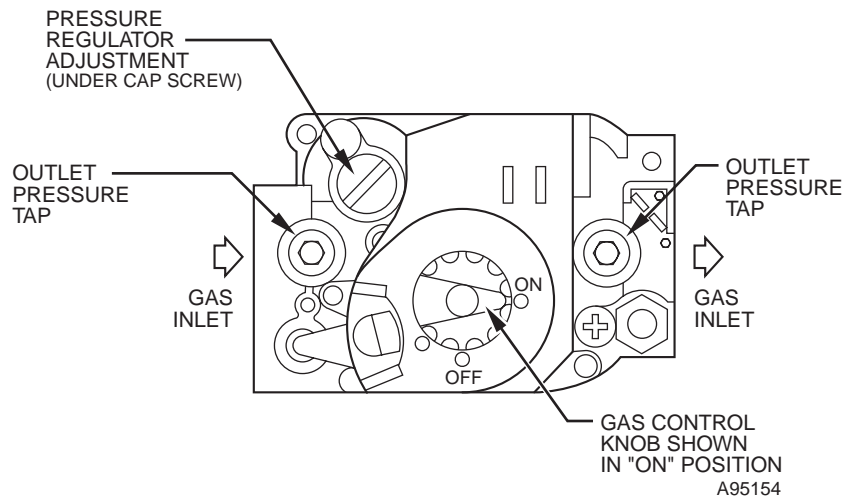


Fig. 23—Gas Valve

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- j. Restore electrical power and gas supply to unit.
2. Check that boiler area is free from combustible materials, gasoline, and other flammable vapors and liquids.

⚠ WARNING: Keep boiler area clean of debris and free of flammable and combustible materials, vapors, and liquids. Failure to follow this warning could result in fire, property damage, personal injury, or death.

3. Circulator pump and blower motor furnished with boiler are permanently lubricated from the factory and require no further lubrication. Additional or non-factory supplied pumps and/or motors should be lubricated according to the pump and/or motor manufacturer's instruction.

PROCEDURE 2—DAILY DURING HEATING SEASON

⚠ WARNING: Disconnect electrical power to unit. Turn off gas supply to unit at the gas supply shutoff. Failure to do so could result in fire, personal injury, property damage, or death.

1. Check for and remove any obstruction to the flow of combustion air or venting of flue gases.
2. Check that boiler area is free from combustible materials, gasoline, and other flammable vapors and liquids.

⚠ WARNING: Keep boiler area clean of debris and free of flammable and combustible materials, vapors, and liquids. Failure to follow this warning could result in fire, property damage, personal injury, or death.

PROCEDURE 3—MONTHLY DURING HEATING SEASON

⚠ WARNING: Disconnect electrical power to unit. Turn off gas supply to unit at the gas supply shutoff. Failure to do so could result in fire, personal injury, property damage, or death.

1. Remove jacket front and top panels and check for piping leaks around relief valve and other fittings. If found, contact a qualified service agency to repair.

⚠ WARNING: DO NOT use stop leak compounds. Failure to do so could result in fire, personal injury, property damage, or death.

2. Test relief valve. Refer to valve manufacturers instructions packaged with relief valve.
3. Visually inspect venting and air intake system for proper function, deterioration, or leakage. If the vent or air intake show any signs of deterioration or leakage, contact a qualified service agency to repair or replace them immediately and to insure proper reassembly and resealing of the vent and air intake system.
4. Visually inspect the clear vinyl condensate lines and the PVC condensate drain pipe for proper operation, leakage, and deterioration. If the condensate lines or drain pipe show any signs of blockage, leakage, or deterioration contact a qualified service agency to clean, repair, or replace them immediately.
5. Check air vent(s) for leakage.
6. Check the air baffle located inside 1-1/2-in. X 2-in. flexible coupling, clean it if necessary and make sure to put it back. Refer to repair parts diagram, mixer and pressure switch assembly.

PROCEDURE 4—PERIODICALLY DURING HEATING SEASON

Where low water cut-offs are used, a periodic inspection of the low water cut-off is necessary, including flushing of float type devices. Refer to low water cut-off manufacturer's specific instructions.

PROCEDURE 5—END OF EACH HEATING SEASON — ANNUAL SHUT DOWN PROCEDURE

1. Follow instructions "To Turn Off Gas To Appliance."
2. If heating system is to remain out of service during freezing weather, and does not contain antifreeze, drain system completely. If boiler will be exposed to freezing temperatures, drain condensate lines. Otherwise, do not drain system or boiler.

PROCEDURE 6—ANNUAL EXAMINATION AND CLEANING OF BOILER COMPONENTS

 **WARNING:** Disconnect electrical power to unit. Turn off gas supply to unit at the gas supply shutoff. Failure to do so could result in fire, personal injury, property damage, or death.

NOTE: The following service procedures must be performed only by a qualified service agency. Boiler owner should not attempt these procedures.

1. Before servicing, turn off electrical power to boiler at service switch. Close manual gas valve to turn off gas supply to boiler.
2. Flue passages between boiler sections are examined by removing 8 sheet metal screws and the inspection plate on the left side jacket panel, and then removing the 20 socket head cap screws and the exposed cleanout cover plate on the boiler sections, being careful to not damage the gasket. Refer to repair parts diagram, boiler block and piping assembly. The procedure for examining and cleaning the burner is also described below.
 - a. Any buildup of sediment or aluminum oxide (white powdery or flaky substance) in the flue passages must be cleaned as follows:
 - b. Remove jacket front and top panels. Disconnect condensate drain line from the barbed fitting on the bottom of the boiler. Keep the open end of the drain line above the water level in the condensate trap to prevent the trap from draining. Disconnect pressure switch hose from barbed fitting on gas valve. Disconnect 1-1/2-in. x 2-in. flexible coupling from air inlet. Disconnect air by-pass (1/2-in. transparent vinyl tube) from the bottom of the mixer.
 - c. Remove air baffle from 1-1/2-in. X 2-in. flexible coupling and clean air baffle if necessary. Refer to repair parts diagram, mixer and pressure switch assembly.
 - d. Confirm that manual gas valve is closed and disconnect gas line to gas valve at union. Disconnect wires to gas valve and igniter.
 - e. Loosen but do not remove 5 nuts attaching mixer assembly to boiler. Remove 2 igniter screws and very carefully remove the igniter.

→ **NOTE:** Loosening the mixer assembly nuts will aid in igniter removal.

 **CAUTION:** Use care when removing the igniter, it is very brittle!

- f. Remove 5 nuts and remove mixer assembly. Remove burner and mixer gasket.
 - g. Aluminum oxide deposits are water soluble and may be rinsed away with spraying or running water. Before rinsing, connect a 1/2-in. I.D. hose to the barbed fitting on the bottom of the boiler and run the hose to a bucket or drain.
 - h. Use a flexible handle nylon brush to loosen sediment and aluminum oxide on all heating surfaces of boiler. Refer to the repair parts diagrams.
 - i. After brushing and rinsing, remove any remaining loosened sediment using a shop vacuum with a snorkel attachment.
 - j. Inspect burner for any foreign matter in the flame ports or inside the burner. Any foreign matter should be removed by blowing with compressed air or vacuuming.
 - k. Inspect interior of mixer for any signs of sediment or aluminum oxide and clean if necessary.
 - l. Reinstall burner and mixer gasket and position mixer assembly over studs. Install 5 nuts but do not tighten. Reinstall igniter and igniter gasket and fasten with 2 screws. Use care when installing the igniter. It is very brittle! Tighten 5 nuts holding mixer assembly.
 - m. Connect:
 - (1.) Gas line to gas valve.
 - (2.) Condensate drain line to boiler.
 - (3.) Pressure switch hose to gas valve.
 - (4.) Air by-pass to mixer.
 - (5.) 1-1/2-in. X 2-in. flexible coupling to air inlet and make sure to put air baffle back to correct position.
 - (6.) Igniter wires.
 - (7.) Gas valve wires.
 - n. Install cleanout cover plate and gasket. Fasten with screws.
 - o. Install inspection plate and fasten with screws.
3. Visually inspect condensate lines leading from the boiler sections and the vent tee to the condensate trap. Refer to repair parts diagrams. Any foreign material or debris that is visible in the condensate lines needs to be cleaned out as follows:
 - a. Raise condensate trap and drain condensate lines completely.

Table 10—Differential Air Pressure Switch Setting

BOILER STATUS	DIFFERENTIAL PRESSURE (W.C.)	PRESSURE SWITCH CONNECTS
Not Running	0-in.	Normally Open
Setpoint	1.0-in. for BW9-100	
	1.35-in. for BW9-75	
	1.55-in. for BW9-50	
Running without Blockage	Greater Than Setpoints	Closed
Running with Blockage	Less Than or Equal to Setpoints	Open

If manometer readings do not correspond to the chart above, check for possible causes:

- Blockage or moisture in suction lines to switch
- Blockage in air intake or vent pipes
- Undersized air intake or vent pipes
- Loose blower wheel on motor shaft
- Incorrect pressure switch or pressure switch setpoint

- b. Once the condensate trap is emptied of water, disconnect condensate lines from the fittings on the boiler, the vent tee, and the condensate outlet.
 - c. Remove the condensate trap and run cold water through the condensate lines to thoroughly flush out any sediment or debris in the lines.
 - d. Reinstall and connect the condensate trap, using the hose clamps to secure the various condensate lines to their fittings.
 - e. Follow the instructions under "Near Boiler Piping" for "filling condensate trap with water."
4. Inspection of the flue connector requires the following steps (Refer to the repair parts diagram.) Inspection of the flue connector requires the following steps (Refer to the repair parts diagram.)
 - a. Loosen the clamp on the draft inducer end of the 2-in. flexible coupling that connects the vent tee to the draft inducer. Disconnect (unplug) wiring harness from draft inducer motor and draft inducer temperature safety switch. Remove 4 bolts that attach draft inducer to flue connector.
 - b. Remove draft inducer and gasket from top of flue connector.
 - c. Inspect interior of flue connector. Any buildup of sediment or aluminum oxide on the inside surface must be cleaned. Position the draft inducer gasket and the draft inducer and fasten with 4 screws. Be sure to connect ground wire from draft inducer motor to one of the four mounting screws.
 - d. Connect wiring harness leads to the draft inducer motor and the draft inducer temperature safety switch.
 - e. Connect the 2-in. flexible coupling to the draft inducer outlet.
 5. Follow start-up and check-out procedures to verify proper operation.

PROCEDURE 7—DIFFERENTIAL AIR PRESSURE SWITCH CHECK

→ The following steps and diagram indicate the locations of the connection points required to check the differential air pressure. The differential air pressure switch is a safety device which will prevent the boiler from firing if there is an air intake, boiler heat exchanger or vent blockage. Refer to Table 10 and Fig. 35.

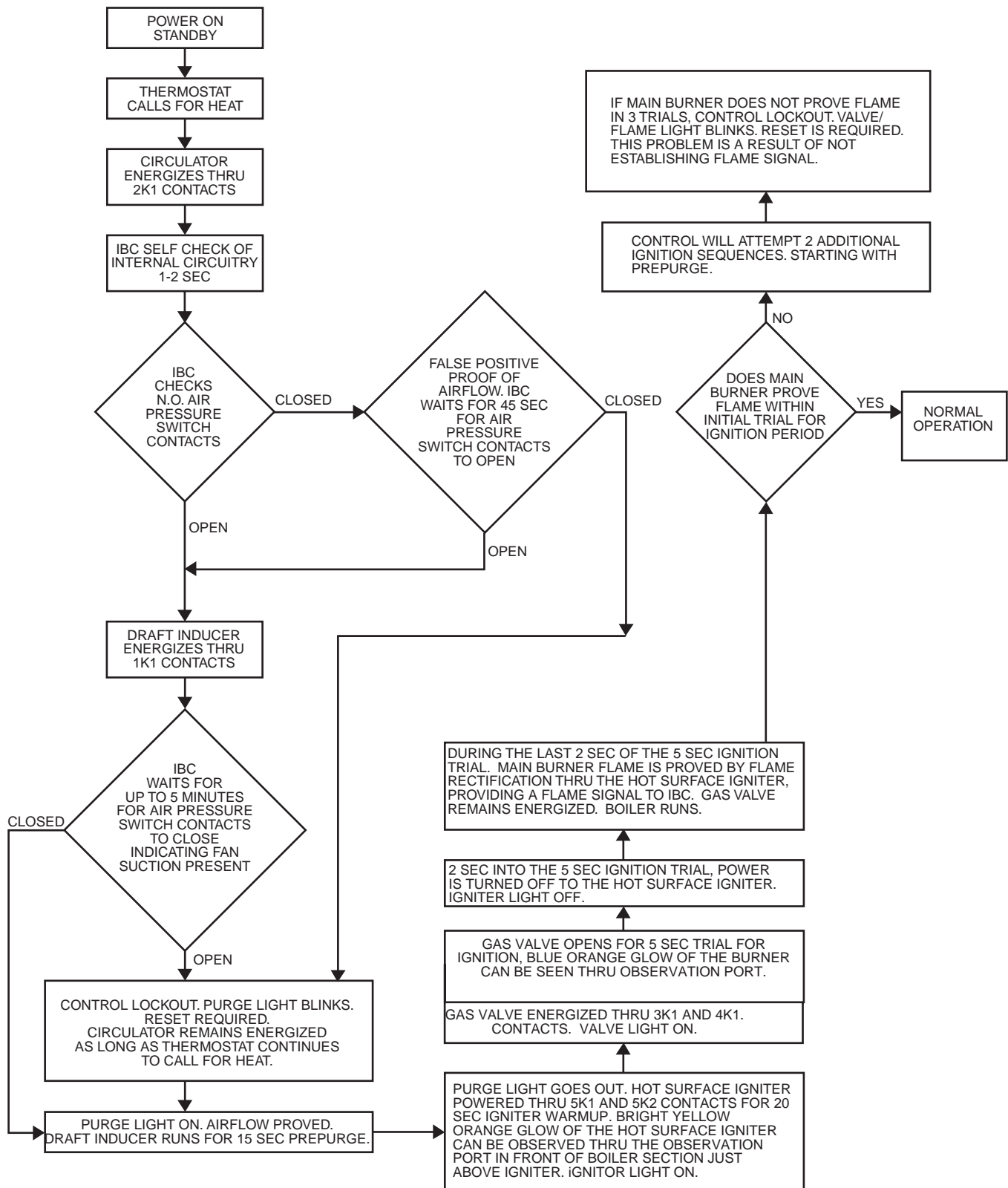
1. Turn off service switch or lower thermostat setting.
2. Remove vinyl caps from tee and 4-way connector.
3. Install testing lines as shown to inclined manometer or differential pressure gauge with the ability to read 0.01-in. to 2.00-in. w.c.
4. Turn on service switch and set thermostat to call for heat.

When pressure reading is proper and the pressure switch is operating properly, remove testing lines and reinstall vinyl caps to tee and 4-way connector.

PROCEDURE 8—SERVICE HINTS

See Fig. 24-35.

NORMAL SEQUENCE OF OPERATION



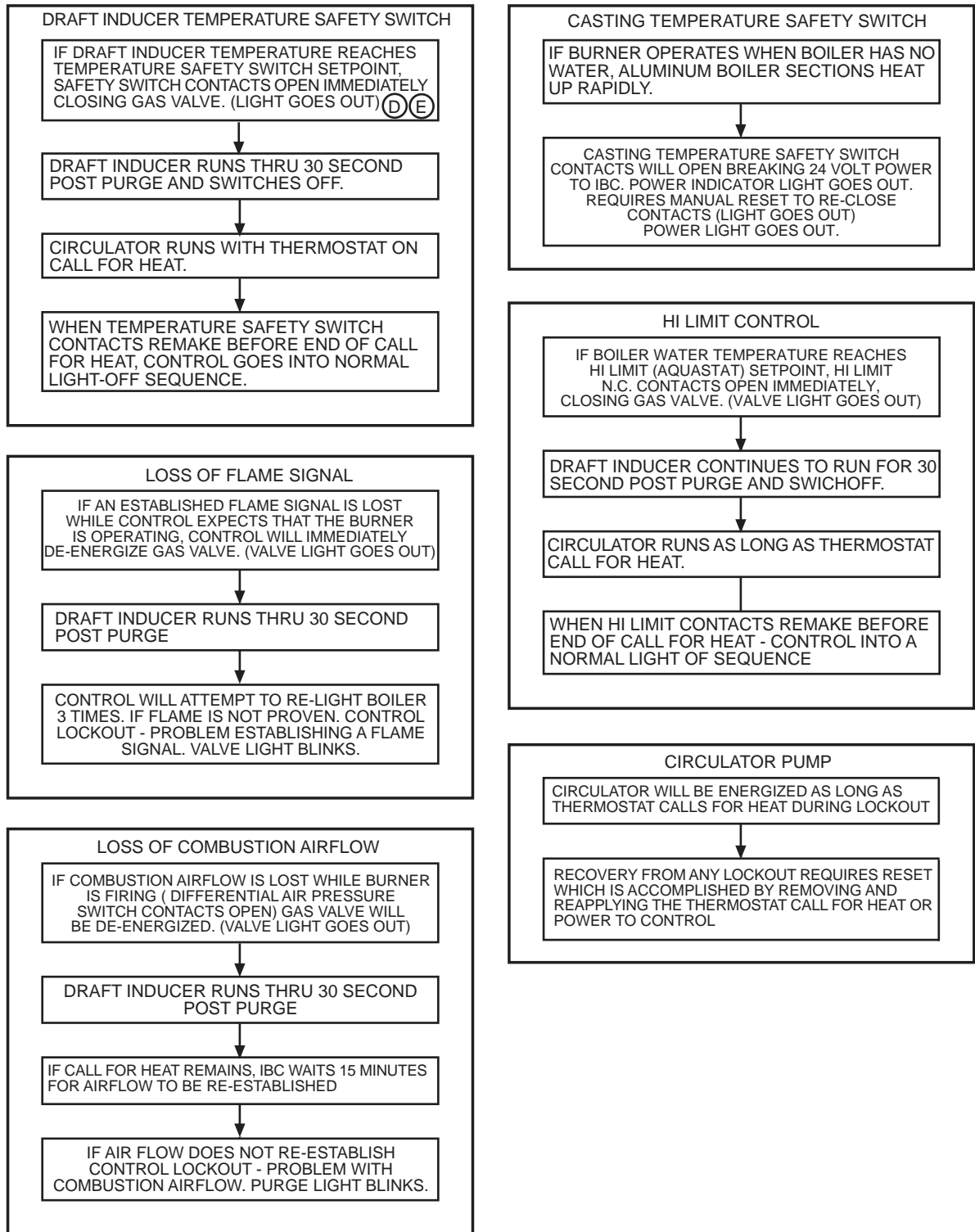
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DETAILED SEQUENCE OF OPERATION

Fig. 24—Normal Sequence of Operation

A00314

SAFETY SEQUENCES DURING OPERATION



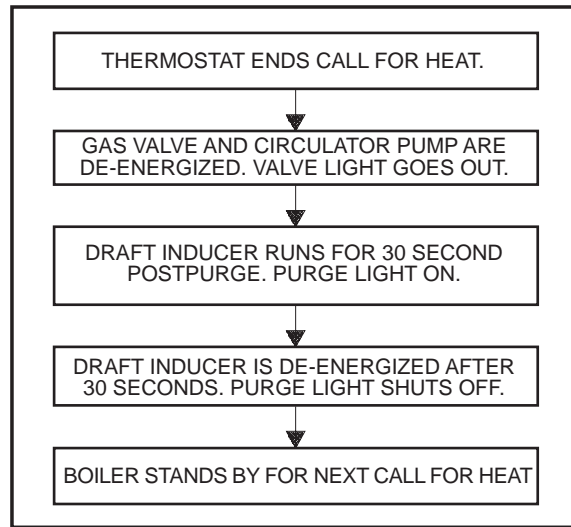
DETAILED SEQUENCE OF OPERATION

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Fig. 25—Safety Sequences During Operation

A00315

END OF NORMAL SEQUENCE OF OPERATION



A

DETAILED SEQUENCE OF OPERATION

Fig. 26—End Of Normal Sequence Of Operation

A00316

!! WARNING !!

FIRE, EXPLOSION OR SHOCK HAZARD MAY CAUSE
PROPERTY DAMAGE, SEVER INJURY OR DEATH.
DO NOT ATTEMPT TO MODIFY THE PHYSICAL OR
ELECTRICAL CHARACTERISTICS OF THIS
BROILER IN ANY WAY.

IMPORTANT

1. IN A RESET FROM LOOKOUT CONDITION, ALL ELECTRICAL METER READINGS ARE THE GAS CONTROL VALVE (24 VAC) MUST BE TAKEN WITHIN THE TRIAL FOR IGNITION PERIOD.
2. IF ANY COMPONENT DOES NOT FUNCTION PROPERLY, MAKE SURE IT IS CORRECTLY INSTALLED AND WIRED BEFORE REPLACING IT.
3. STATIC ELECTRICITY DISCHARGE CAN DAMAGE THE INTEGRATED BOILER CONTROL (IBC). TOUCH METAL SURFACE TO DISCHARGE STATIC ELECTRICITY BEFORE TOUCHING IBC.
4. THE IBC CANNOT BE REPAIRED. IF IT MALFUNCTIONS IT MUST BE REPLACED.
5. ONLY TRAINED, EXPERIENCED SERVICE TECHNICIANS SHOULD SERVICE THE IBC SYSTEMS. FOLLOWING TROUBLESHOOTING, CHECK OUT THE SYSTEM FOLLOWING THE SEQUENCE OF OPERATION SECTION OF THIS CHAPTER FOR NORMAL LIGHT OFF SEQUENCE.
6. ALL CONTROLS ARE FACTORY TESTED AT LEAST ONCE IN THE ASSEMBLY PROCESS AND DEFECTIVE CONTROL IS GENERALLY THE LEAST LIKELY CAUSE. IF YOU SUSPECT YOU HAVE A DEFECTIVE CONTROL, DOUBLE CHECK YOUR PATH THROUGH THE TROUBLESHOOTING CHART BEFORE YOU REPLACE IT.
7. IT IS ALSO IMPORTANT TO REMEMBER THAT THE LIKELIHOOD OF COMING ACROSS TWO IDENTICAL DEFECTIVE CONTROLS IN A ROW IS ALMOST NIL. IF IT SEEMS TO BE HAPPENING, CHANCES ARE THAT EITHER THERE IS NOTHING WRONG WITH THE CONTROL OR IT IS BEING DAMAGED BY SOME OTHER PROBLEM (A SHORT BURNIGN OUT A TRANSFORMER, FOR EXAMPLE).

INITIAL SERVICE CHECKS















1. BEFORE TROUBLESHOOTING
 - A. MAKE SURE THAT CIRCUIT BREAKER IS ON OR FUSE IS OK AT ELECTRICAL PANEL
 - B. MAKE SURE THAT SERVICE SWITCH IS ON .
 - C. MAKE SURE THAT GAS IS ON AT THE GAS METER, AT ALL APPROPRIATE MANUAL SHUTOFF VALVES AND AT THE GAS CONTROL VALVE.
 - D. MAKE SURE THAT THE THERMOSTAT IS CALLING FOR HEAT
 - E. CHECK THAT WIRE CONNECTORS AT THE INTEGRATED BOILER CONTROL AND AT THE ORIGINATING CONTROL ARE SECURELY PLUGGED IN OR CONNECTED
 - F. CHECK THE HOSES ARE SECURELY CONNECTED AND ARE NOT PLUGGED OR DAMAGED.
2. TROUBLE-SHOOTING TOOLS:
 - A. VOLTMETER TO CHECK 120 VAC AND 24 VAC.
 - B. CONTINUTIY TESTER
 - C. INCLINED MANOMETER OR PRESSURE GAUGE WITH 0 - 20" RANGE (0.01" SCALE) FOR MEASURING SECTION PRESSURES AT PRESSURE SWITCH.
 - D. U-TUBE MANOMETER OR DIFFERENTIAL PRESSURE GAUGE WITH 0 - 14" RANGE (0.1" SCALE) FOR MEASURING INLET AND MANIFOLD GAS PRESSURES.
3. WHAT IS SYSTEM STATUS?
 - A. CONSULT THE CHART ON THE FOLLOWING PAGE.
 - B. FIGURE 16 SHOWS THE LOCATION ON THE BOILER OF THE DIAGNOSTIC INDICATOR LAMPS.

B

TROUBLE SHOOTING

Fig. 27—Initial Service Checks

A99349

SYSTEM STATUS			
<p>THE INDICATOR LIGHTS TRACK THE OPERATING SEQUENCE. IF THE SYSTEM LOCKS OUT, THE LIGHTS INDICATE THE POINT IN THE SEQUENCE OF OPERATION WHERE LOCKOUT OCCURS. IF THIS TABLE DOES NOT READILY PROVIDE THE REASON FOR BOILER MALFUNCTION OR NON-OPERATION, REFER TO THE FOLLOWING PAGES FOR MORE DETAILED TROUBLESHOOTING PROCEDURES.</p>			
LIGHT	SYMBOL	STATUS	INDICATES
POWER		ON	IBC IS ENERGIZED THROUGH 24 VOLT TRANSFORMER.
		OFF	IBC IS NOT ENERGIZED.
		BLINKING	MORE THAN 40 VAC IS APPLIED TO IBC CONTROL
PURGE		ON	IBC IS ENERGIZING THE DRAFT INDUCER AND AIR FLOW IS PROVEN.
		OFF	OFF DURING PURGE CYCLE – DRAFT INDUCER IS NOT POWERED OR AIR FLOW IS NOT PROVEN. OFF DURING IGNITER AND RUN CYCLE – NORMAL OPERATION, PURGE CYCLE COMPLETE
		BLINKING	IBC IS LOCKED OUT. PROBLEM COULD INDICATE FALSE POSITIVE PROOF OF AIR FLOW, BLOCKED VENT OR INTAKE AIR PIPE OR FLUE WAY.
IGNITER		ON	IBC IS ENERGIZING IGNITER
		OFF	IGNITER IS NOT ENERGIZED
VALVE		ON	IBC IS ENERGIZING GAS CONTROL VALVE TO OPEN.
		OFF	GAS CONTROL VALVE IS CLOSED.
		ON	IBC IS LOCKED OUT. FLAME HAS NOT BEEN PROVEN IN 3 IGNITION ATTEMPTS. MAYBE DUE TO BROKEN IGNITION LOW FLAME SIGNAL, NO ELECTRICAL GROUND OR NO GAS.
FLAME		ON	FLAME HAS BEEN SENSED
		OFF	NO FLAME SENSED
		BLINKING	POLARITY IS REVERSED. VERIFY LINE POWER CONNECTED TO L1, NEUTRAL TO L2

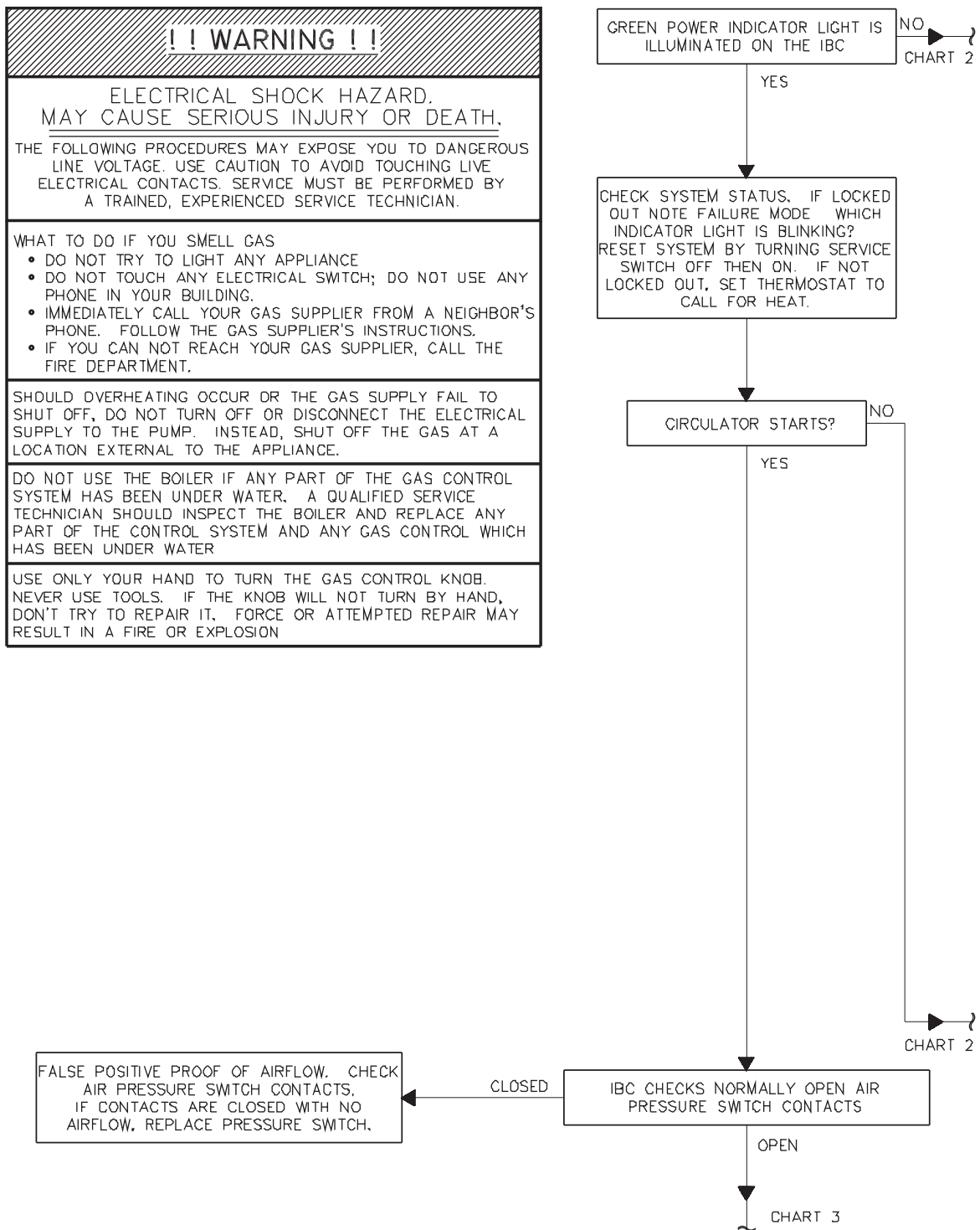
B

TROUBLESHOOTING

Fig. 28—System Status Symbols

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TROUBLESHOOTING CHART I



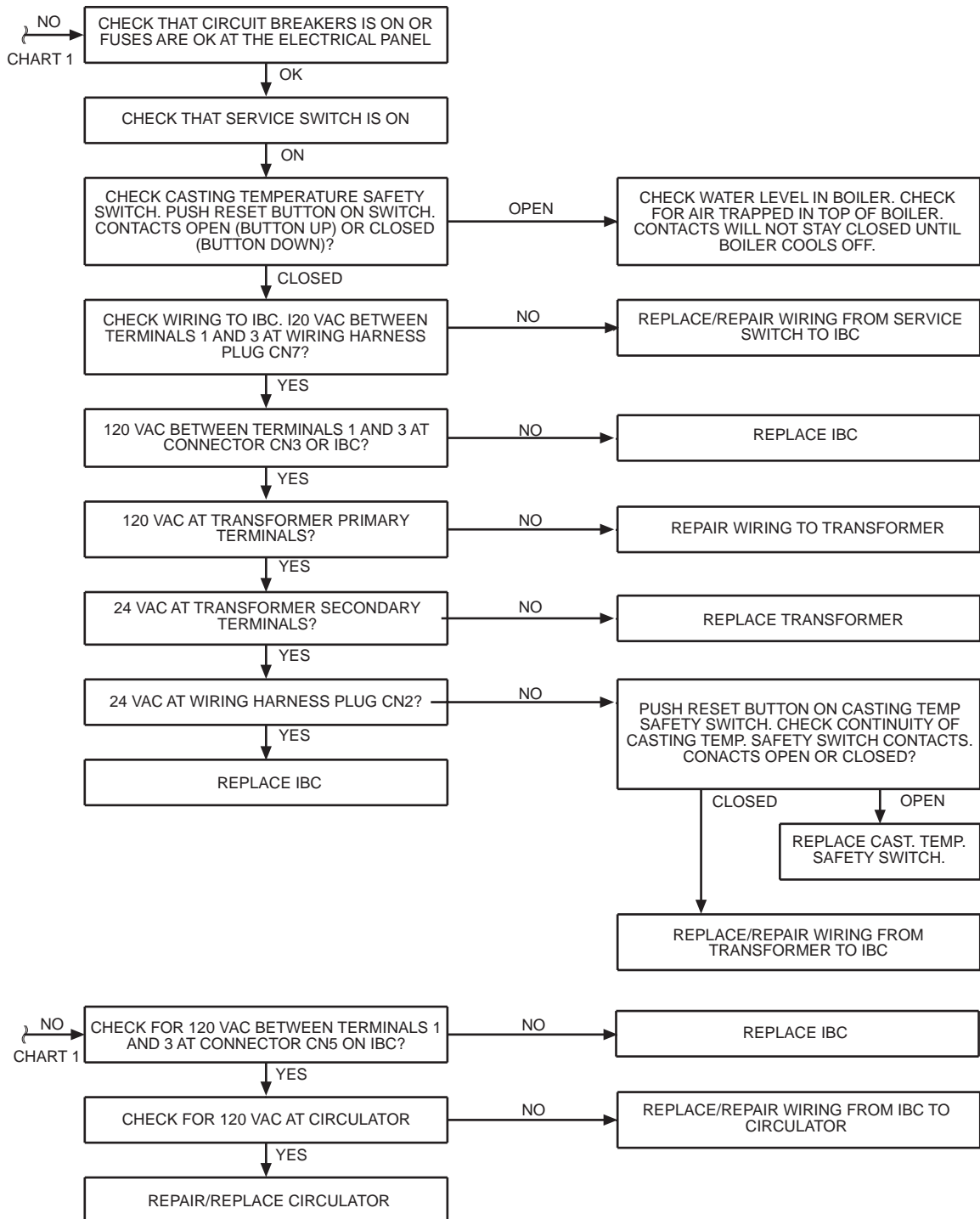
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TROUBLESHOOTING

Fig. 29—Troubleshooting Chart No. 1

A00318

TROUBLESHOOTING CHART 2



TROUBLESHOOTING

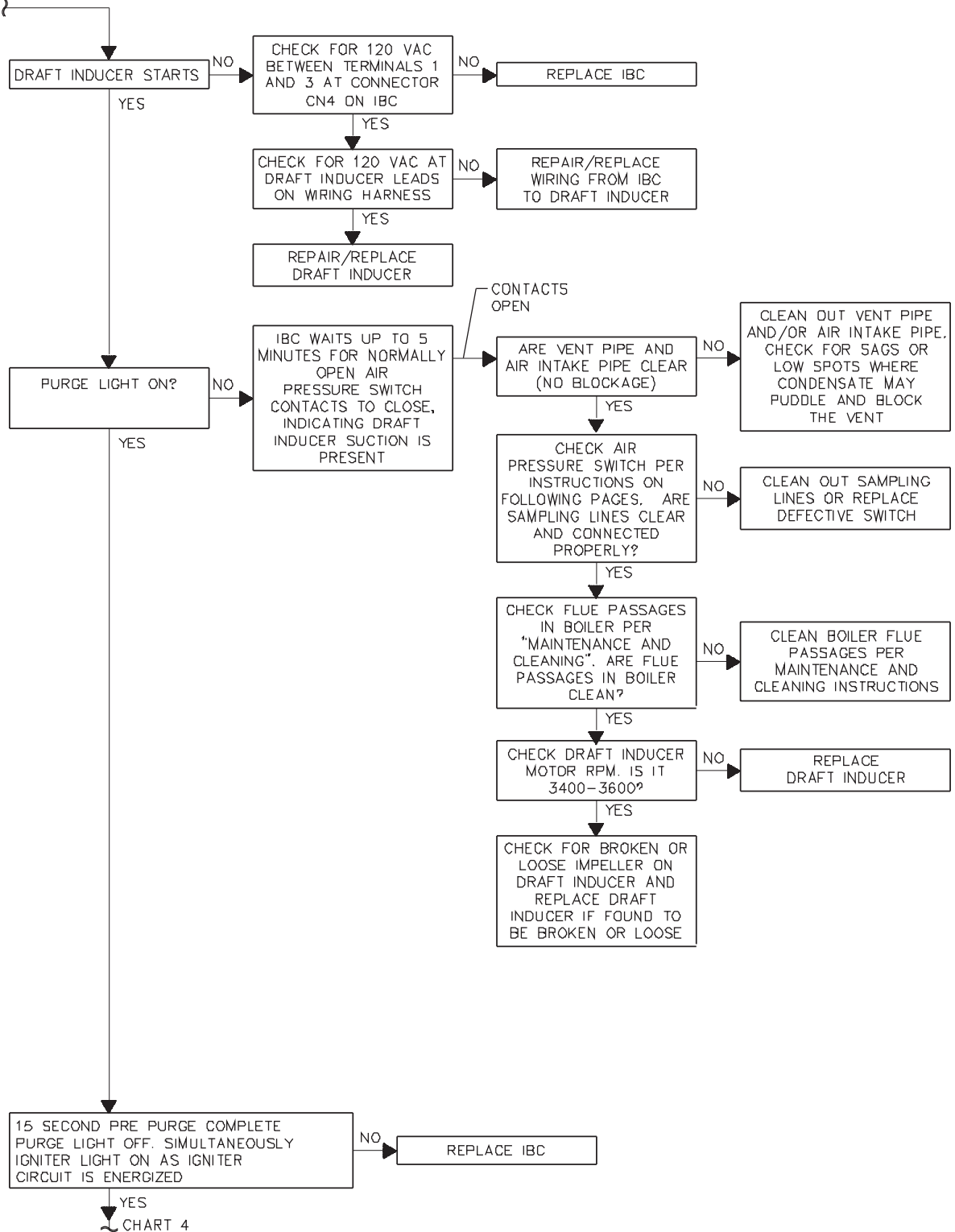
B

Fig. 30—Troubleshooting Chart No. 2

A99352

CHART 1
OPEN

TROUBLESHOOTING CHART 3



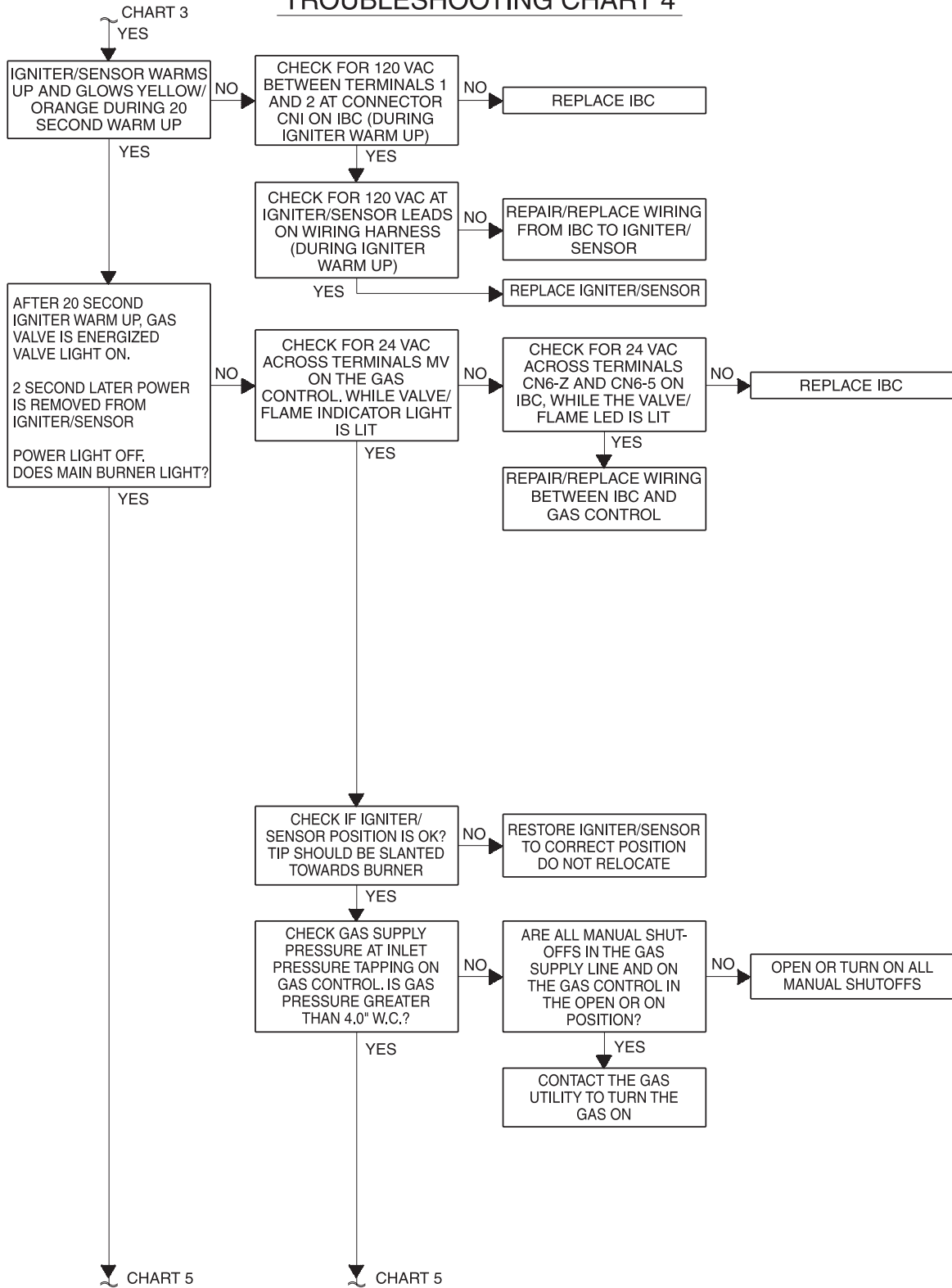
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TRUBLE SHOOTING

Fig. 31—Troubleshooting Chart No. 3

A00319

TROUBLESHOOTING CHART 4



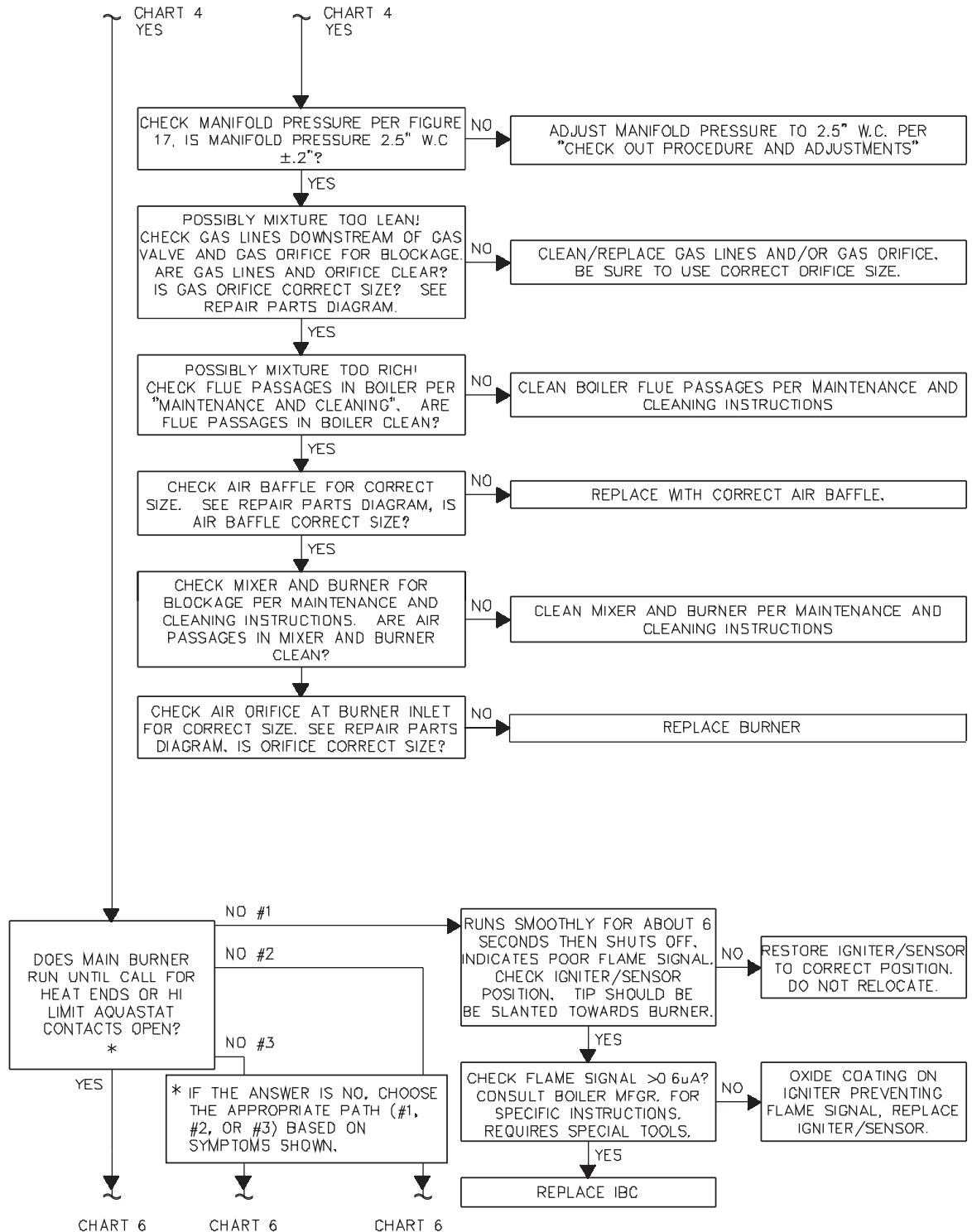
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TROUBLESHOOTING

Fig. 32—Troubleshooting Chart No. 4

A00320

TROUBLESHOOTING CHART 5



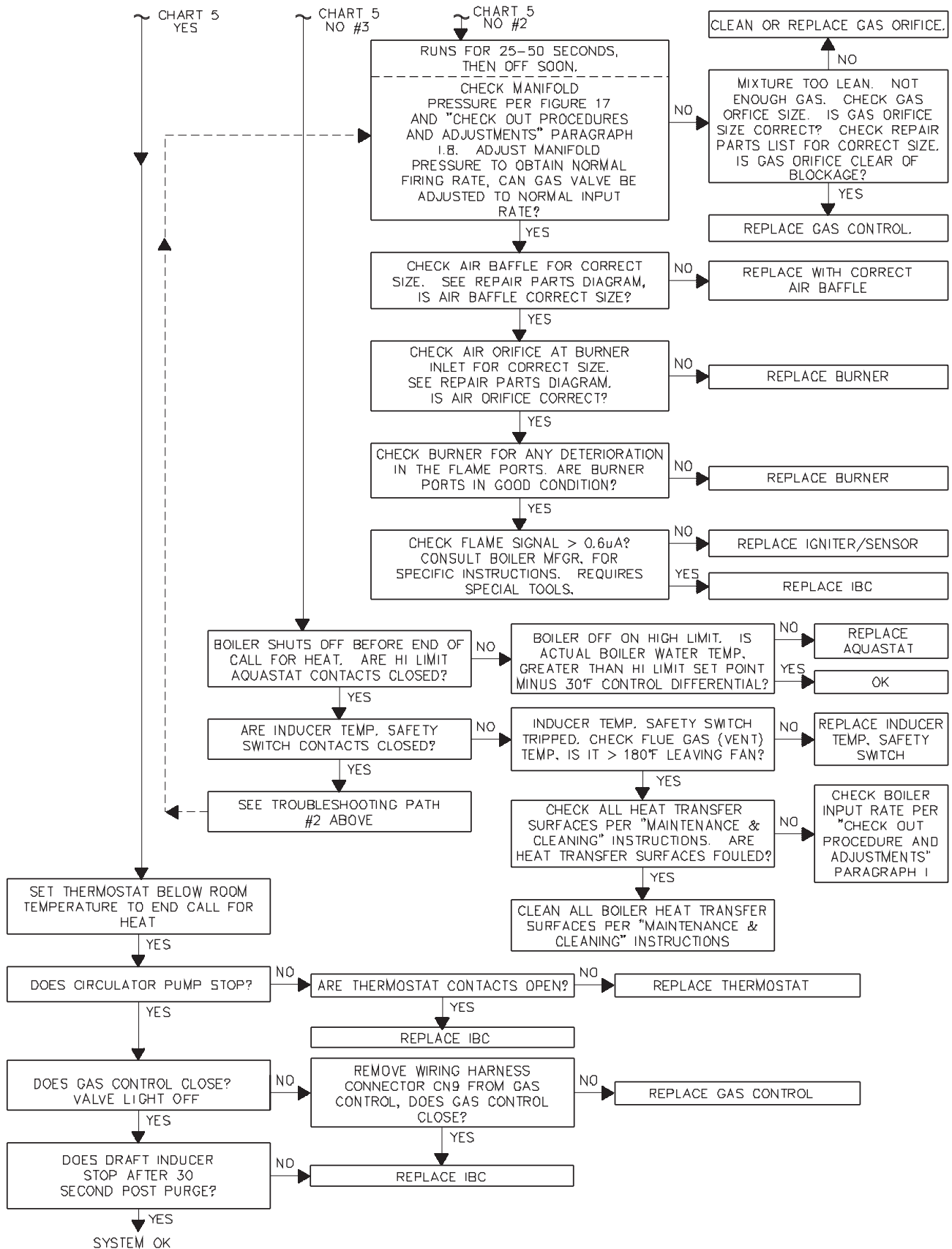
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TROUBLESHOOTING

Fig. 33—Troubleshooting Chart No. 5

A00321

TROUBLESHOOTING CHART 6



B

TROUBLESHOOTING

Fig. 34—Troubleshooting Chart No. 6

A00322

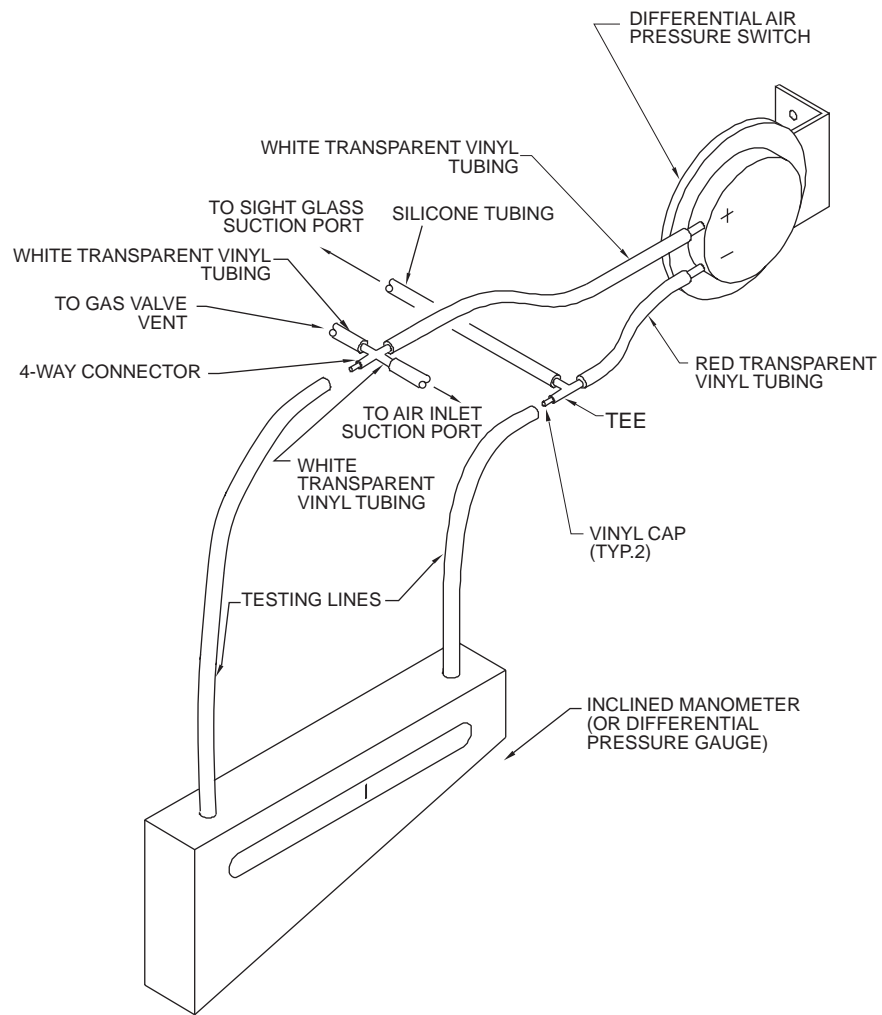


Fig. 35—Differential Air Pressure Switch and Gauge

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PROCEDURE 9—REPAIR PARTS

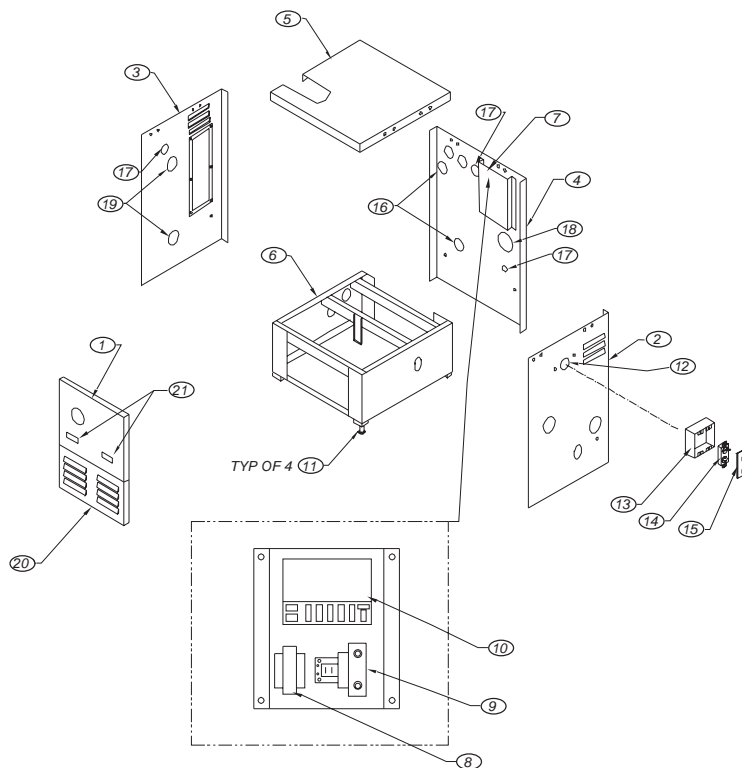
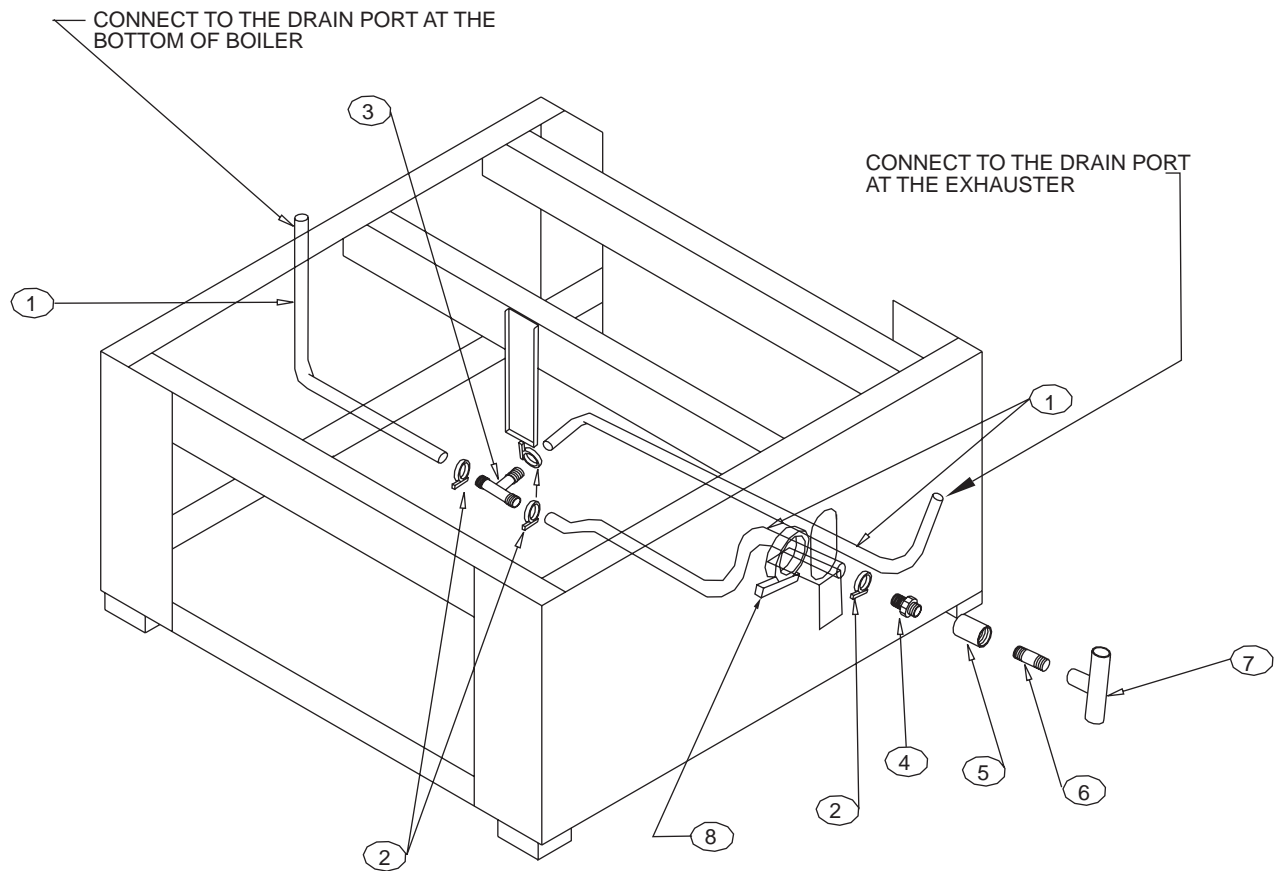


Fig. 36—Jacket and Base Assembly

A99174

KEY NO.	ITEM NUMBER	DESCRIPTION	QUANTITY
1	750701020	Q90 Front Panel — Blue	1
2	750701021	Q90 Right Panel — Blue	1
3	750701022	Q90 Left Panel — Blue	1
4	750701023	Q90 Back Panel — Blue	1
5	750701024	Q90 Top Panel — Blue	1
6	750701025	Q90 Base	1
7	650001026	Q90 Control Panel	1
8	14662801	AT140B1016 Transformer 24 VAC	1
9a	14631312	PPS10111-2680 Air Pressure Switch (Q90-100)	1
9b	14631010	PPS10111-2681 Air Pressure Switch (Q90-75)	1
9c	14631044	PPS10111-2682 Air Pressure Switch (Q90-50)	1
10	14662803	UT 1013-10 Intergrated Boiler Control	1
11	14631091	CO2366 Glide	4
12	14631120	HEYCO OCB-1500 Bushing	1
13	14631316	RACO 232 4X4X2 Box	1
14	14631319	P&S Switch 691-I	1
15	14631318	Cover Plate Raco 902-802	1
16	14631174	419-1AA1 2-1/2-in. Plug	2
17	14631171	415-1AA1 1-1/2-in. Plug	2
18	14631176	BPF 3-1/2-in. Plug	1
19	14631175	421-1AA1 3-in. Plug	2
20	750701027	Q90 Lower Front Panel — Blue	1
21	CI-001.03	Taco Circulating Pump	1
*	14626043	Taco Isolation Valve Set-Optional, Not Furnished	1
*	CI-006.01	Grundfos Circulating Pump	1
*	14626043	Grundfos Isolation Valve Set-Optional, Not Furnished	1
*	43300826	Circulating Pump Harness	1
*	14631328	Q90 Wiring Harness	1
*	750701002	Jacket Complete	1

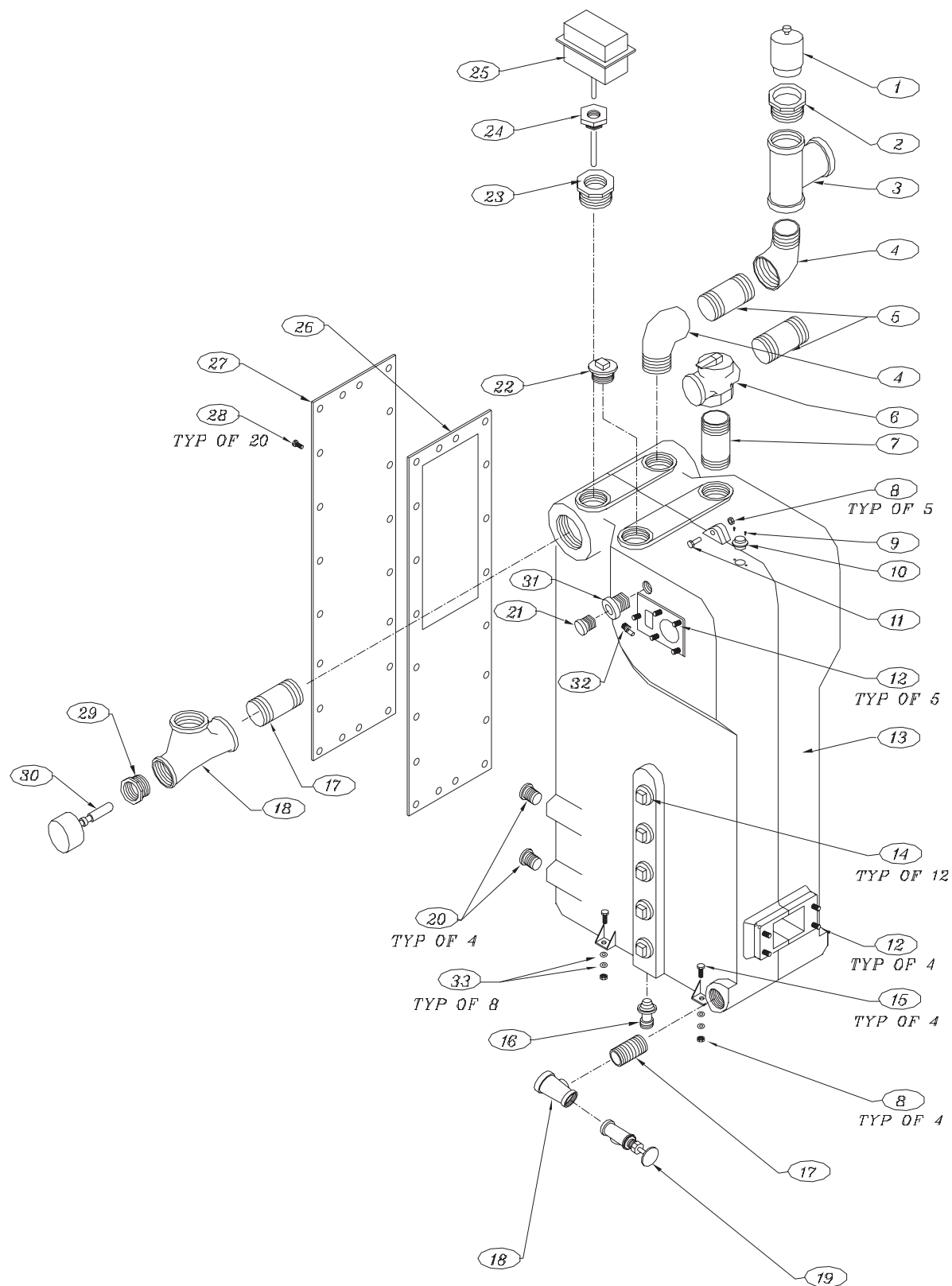
*Not Shown



A99175

Fig. 37—Condensate Drain Trap Assembly

KEY NO.	ITEM NUMBER	DESCRIPTION	QUANTITY
1	14631035	59019 1/2-in. ID X 1/8-in. thick Vinyl Tubing	6
2	14631114	57134 3/4-in. Snap Grid Clamp	1
3	14631320	62067 1/2-in. ID Hose Tee	1
4	14631101	62017 1/2-in. NPTX1/2-in. ID Tube Straight	1
5	14631321	1/2-in. PVC Coupling, Sch 80	1
6	14631306	1/2-in. X 4-in. PVC Nipple, Sch 80	1
7	14631110	1/2-in. ID X 1/2-in. ID X 1/2-in. NPT Tube Tee	1
8	14631323	S.S. Clamp, Size 16 (13/16-in. x 1-1/2-in.)	1



A99176

Fig. 38—Boiler Block and Piping Assembly

→	KEY NO.	ITEM NUMBER	DESCRIPTION	QUANTITY
	1	14631156	Hoffman Vent #77	1
	2	14693001	3/4-in. X 1/8-in. Bushing	1
	3	14693076	3/4-in. Black Tee	1
	4	14693040	3/4-in. X 90 Street Elbow	2
	5	14607002	3/4-in. X 6-1/2-in. Nipple	2
	6	14622011	3/4-in. ASME Relief Valve	1
	7	14607201	3/4-in. X 2 Nipple	1
	8	14695810	1/4-in. -20 Hex Nut w/ Serrated Washer Head	9
	9	14695802	8-32 X 3/16-in. Soc Hd Cap Screw	2
	10	14631000	36T26-42930 Casting Temp. Safety Switch	1
	11	14695801	1/4-in. -20 X 1-1/2 Soc Hd Cap Screw	5
	12	14695805	1/4-in. -20 X 1-1/4-in. Stud Threaded	9
	13	41800910	Tested Block (Includes 8, 11, 14, 20, and 22)	1
	14	1395002	1-1/4-in. Sq Head Solid Plug	12
	15	14695040	1/4-in. X 1-1/4-in. Carriage Bolt	4
	16	14631101	62017 1/2-in. NPT X 1/2-in. ID Tube Straight	1
	17	14607044	1-1/4-in. X 2-1/2-in. Nipple Black	2
	18	1510001	1-1/4-in. X 3/4-in. X 1-1/4-in. Tee	2
	19	14622000	3/4-in. Drain Valve	1
	20	14693056	1-in. Sq Socket Plug	4
	21	14619002	Empire Sight Glass	1
	22	1395001	3/4-in. Sq Hd Plug	1
	23	14693004	3/4-in. X 1/2-in. Bushing	1
	24	14662804	123869A Control Well 1/2-in. NPT	1
	25	14631324	L4006A 2155B Hi Limit Aquastat	1
	26	14631021	Cleanout Cover Plate Gasket	1
	27	740004004	Cleanout Cover Plate	1
	28	14695800	1/4-in. -20 X 5/16-in. Soc Hd Cap Screw	20
	29	1060002	3/4-in. X 1/4-in. Bushing	1
	30	1260006	Temp & Pressure Gage	1
	31	14631004	Sight Glass Adapter	1
	32	14631005	1/8-in. NPT 1/4-in. Hose ID Brass Barb Fitting	1

*Not Shown

TO SIGHT GLASS ADAPTER

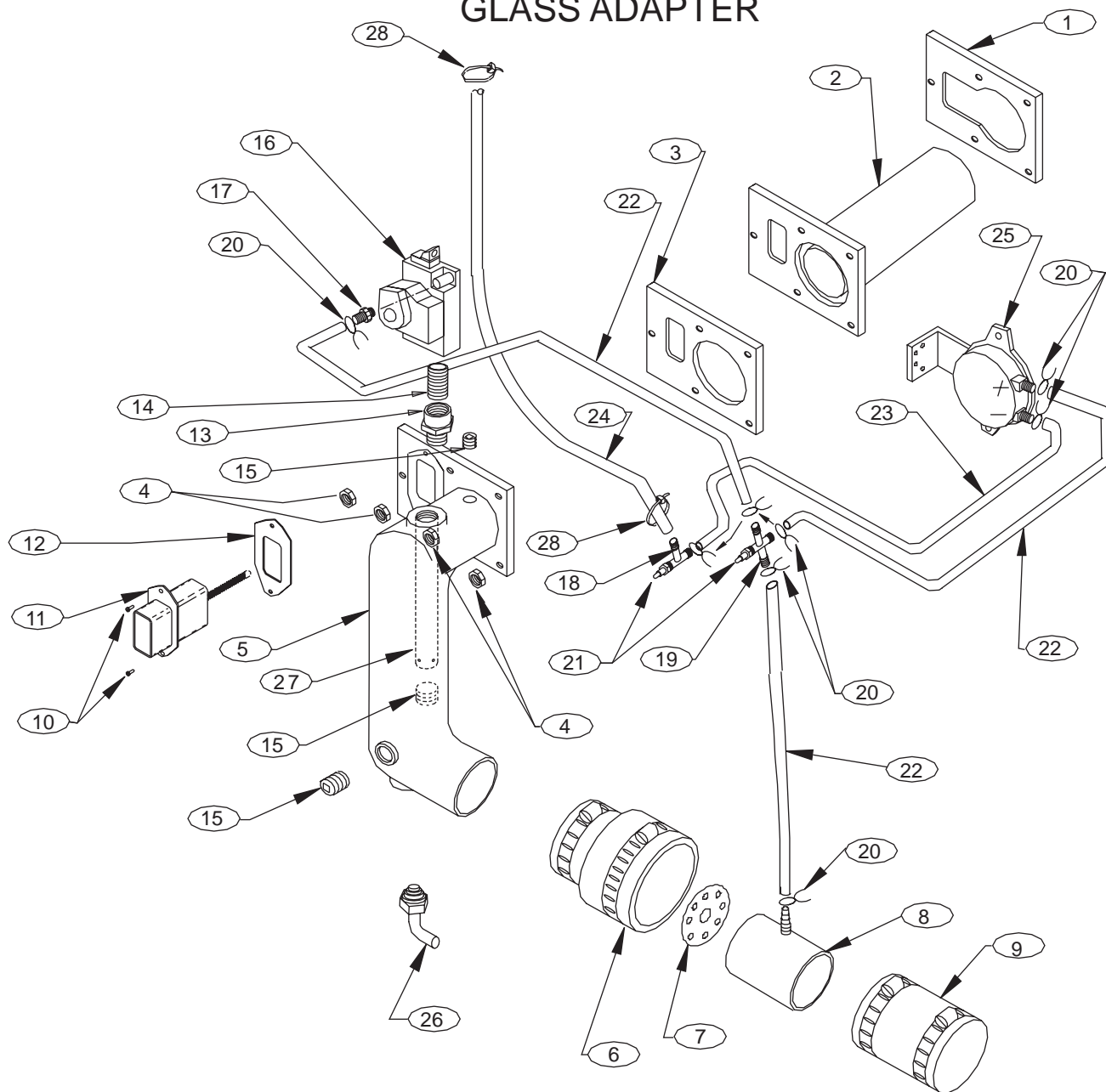
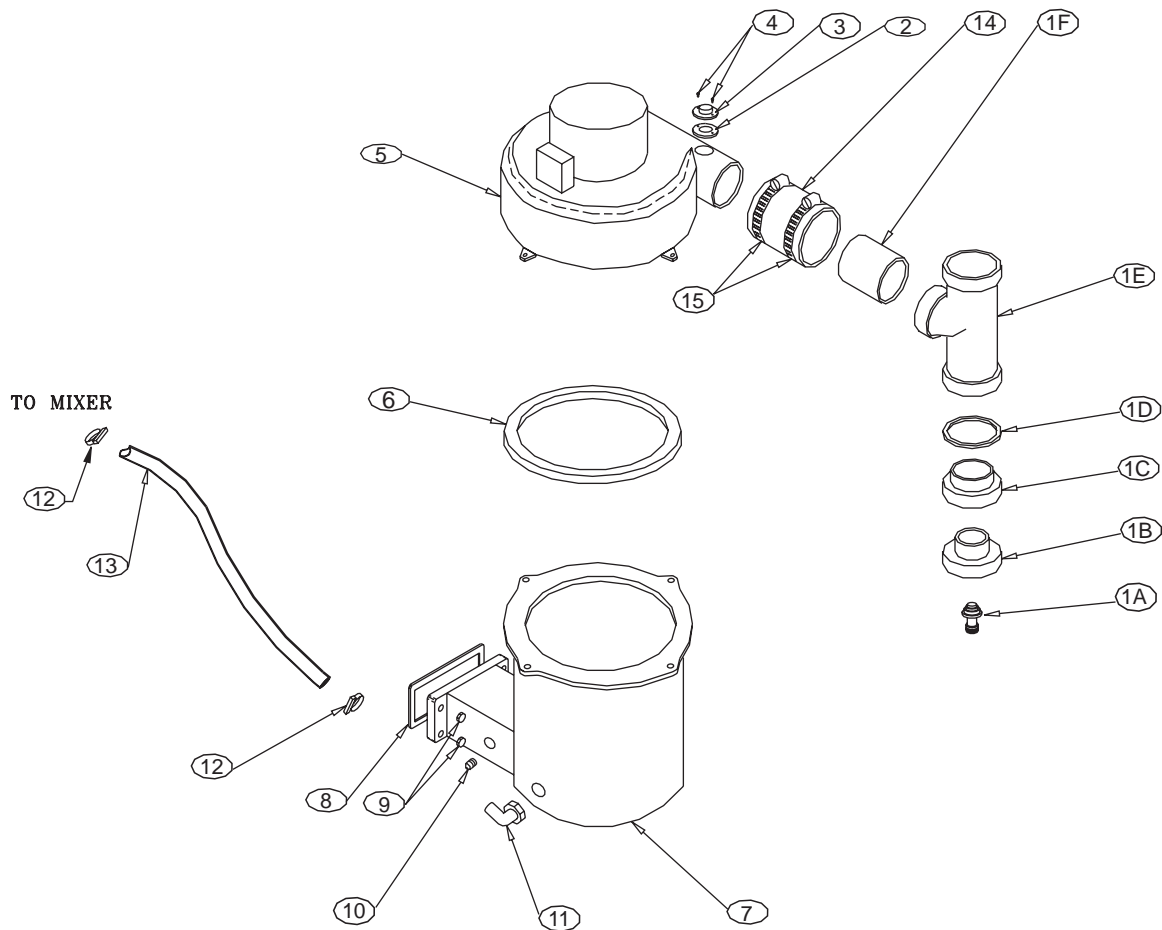


Fig. 39—Mixer and Air Pressure Switch Assembly

A99177

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KEY NO.	ITEM NUMBER	DESCRIPTION	QUANTITY
1	14631023	Burner Gasket	1
2a	14631006	BW9-100 Burner	1
2b	14631007	BW9-75 Burner	1
2c	14631008	BW9-50 Burner	1
3	14631025	Mixer Gasket	5
4	14695810	1/4-in. -20 Hex Nut w/ Serrated Washer Head	1
5	12101008	Mixer Casting Machined	1
6	14631311	2-in. X 1-1/2-in. Flexible Coupling	1
7a	42531100	BW9-100 Air Baffle	1
7b	42531101	BW9-75 Air Baffle	1
7c	42531102	BW9-50 Air Baffle	1
8	42531103	Air Inlet	1
9	14631015	2-in. Fernco Coupling	1
10	14695809	10-32-in. X 3/8-in. Machine Screw	2
11	4380013	BW9-Ignitor	1
12	14631024	Hot Surface Igniter Gasket	1
13	14631309	Mixer Bushing	1
14	14607301	1/2-in. X 3-in. Std Black Nipple	1
15	14693805	1/8-in. NPT Steel Plug — 3/16-in. Hex Socket	3
16	14631307	Honeywell Gas Valve VR8205	1
17	14631308	5/16-24 X 1/4 Hose ID Brass Barb Fitting	1
18	14631104	62064 1/4-in. ID Tube Tee	1
19	14631313	1/4-in. ID Tube 4-way Connector	1
20	14631143	1/4-in. ID Tube 4-way Connector3/8-in. Hose Clamp HC-6ST	10
21	14631151	PC250-12 Vinyl Cap	2
22	14631033	59006 1/4-in. ID X 3/8-in. OD Vinyl Tubing	AS REQUIRED
23	14631314	1/4-in. ID X 3/8-in. OD Vinyl Tubing (Red)	AS REQUIRED
24	14629003	1/4-in. ID Silicone Tubing	AS REQUIRED
25a	14631312	PPS10111-2680 Air Pressure Switch (BW9-100)	1
25b	14631010	PPS10111-2681 Air Pressure Switch (BW9-75)	1
25c	14631044	PPS10111-2682 Air Pressure Switch (BW9-50)	1
26	14631103	62043 1/2-in. NPT X 1/2-in. ID Tube Elbow	1
27a	14631310	Gas Orifice — Natural, 100N (0.0860)	1
27b	14631029	Gas Orifice — Natural, 75N (0.0760)	1
27c	14631030	Gas Orifice — Natural, 50N (0.615)	1
27d	14631032	Gas Orifice — Propane, 100P (0.0670)	1
27e	14631036	Gas Orifice — Propane, 75P (0.0605)	1
27f	14631037	Gas Orifice — Propane, 75P (0.0605)Gas Orifice — Propane, 50P (0.0492)	1
28	14691002	Tie Nylon	1



A99178

Fig. 40—Flue Adapter and Exhauster Assembly

KEY NO.	ITEM NUMBER	DESCRIPTION	QUANTITY
1	43331109	Exhaust Tee Assembly — 1-A, B, C, D, E, & F	1
1a	14631101	62017 1/2-in. NPT X 1/2-in. ID Tube Straight	1
1b	14631103	PVC 1-1/2-in. Male Slip X 1/2-in. Female NPT	1
1c	14631014	PVC Sch 40 2-in. X 1-1/2-in. Reducer	1
1d	14695815	3/4-in. Aluminum Flat Washer	1
1e	14631305	2-in. CPVC Tee, Sch 80	1
1f	14631304	2-in. CPVC Pipe X 2-1/2-in., Sch 40	1
2	14631028	Vent Switch Gasket	1
3	14631303	36TX11-22491 Inducer Temp Safety Switch	1
4	14695808	#4-20 X 1/4-in. HWH Plast Form Screw	2
5*	2272065	116516-11 Induced Draft Blower Kit	1
6	14631026	Blower Gasket	1
7	12101021	Flue Connector	1
8	14631027	Recovery Coil Gasket	1
9	14695810	1/4-in. -20 Hex Nut w/ Serrated Washer Block	4
10**	14693804	1/8-in. NPT 1/4" Hose ID Brass Barb Fitting	1
11	14631103	62043 1/2-in. NPT X 1/2-in. ID Tube Elbow	1
12	14631141	57134 3/4-in. Snap Grip Clamp	2
13	14631035	59019 1/2-in. ID X 1/8-in. Thk Vinyl Tube	AS REQUIRED
14	14631301	Hose, 3-in. Long 2-3/8-in. ID X 2-3/4-in. OD	1
15	14631302	S. S. Clamp, Size 44	2
16	14631151	PC250-12 Vinyl Cap	2
17	14631143	3/8" Hose Clamp HC-6ST	2

*Includes items #2,3,4,5,6,16,17

**Combustion test port

